SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXII.—No. 13. [NEW SERIES.] | NEW YORK, MARCH 26, 1870. | $3 per Annum [IN ADVANCE]

Improvement in Machines for Dressing Millstones.

The use of the black diamond or carbon diamond points in the mechanic arts is rapidly extending. It is found that when properly applied they are capable of cutting and drilling the hardest materials. This property has originated many attempts to practically apply such points to the dressing of millstones.

Machines for dressing burrs with the diamond points may be divided into two classes; those which produce their effect by the drawing or dragging of the diamond over the face of the stone, and those which employ revolving cutters, by which the cutting performed resembles fine chipping. Machines employing the draw-cut are forced to connect with it some device (usually a spring) for regulating the pressure of the point and rendering it approximately uniform. This introduces an important defect in their working; namely, that the tool enters all the hollows of the stone, and cuts them as well as the high portions, thus operating to perpetuate defects in the face of the stone, instead of simply cutting off the high portions and ultimately reducing the face to a perfect plane.

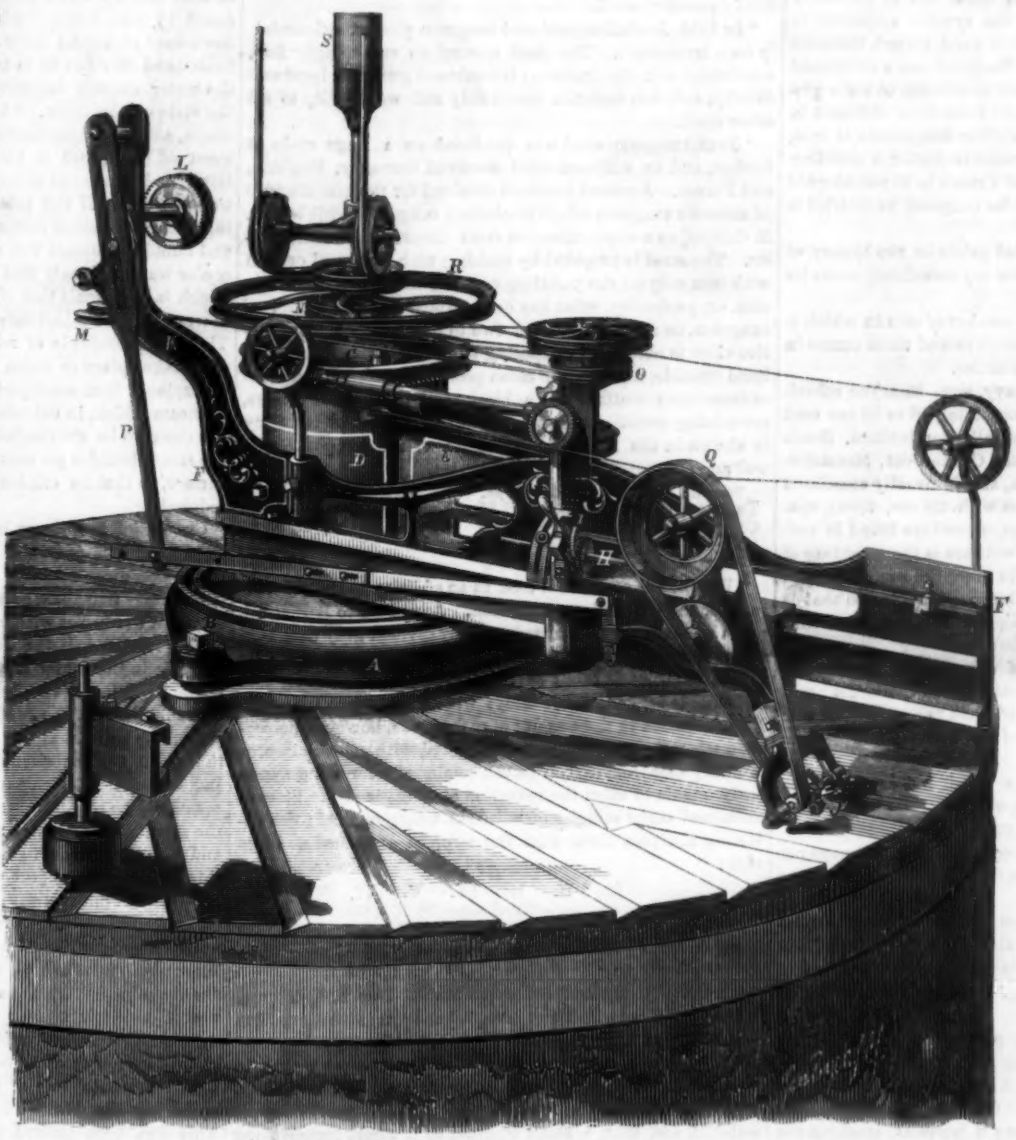
The objects sought in dressing millstones are to level their faces and impart to them a series of "cracks" or fine cutting edges. The positions of these cutting edges vary greatly in different styles of dressing stones, and a machine destined to supersede hand work must be adapted to perform any kind of dress preferred by individual millers, whose opinions vary widely on this subject.

The machine we herewith illustrate has this capacity combined with the principle of revolving cutters, moving constantly in a fixed plane at right angles to the vertical axis of the stone, whereby the high portions only are dressed, until the faces of the burrs are brought to a dead level. Thus all the defects hitherto attending the use of diamond millstone dressing machines are wholly avoided, and a dress imparted to the stone superior in every way to that obtained by the pick, and at a very much less expense. The first patent for the revolving cutter was granted to Mr. J. T. Gilmore, May 26, 1863, but this invention has been mostly withheld from the public since, from the fact that a patent was subsequently granted to a Swiss inventor, Mr. Golay, which resulted in litigation, and finally a compromise, by which we are informed the Golay interest is now wholly vested in the owners of this machine.

The way is now therefore opened for the introduction of this device throughout the country; the value of which is indicated by the fact that the Golay machine, involving the same general principle, but inferior in construction, has been widely introduced in Europe, and is in universal favor there. Darblay, the most extensive miller in the world, at Corbeil, near Paris, whose mills contain 116 runs of burrs, says: "I have eighteen machines, and I consider it the most notable progress ever made in our industry."

The most extensive miller in Glasgow—38 runs of burrs—says no practical miller would be without it for £100 per run if he once had experience of the great value of the diamond dressing machine. This is only a sample of the testimony of a large number of the most celebrated millers in Europe and Canada in favor of the Golay machine.

The Gilmore machine has, it is claimed, a form superior to any other, from the facts that it is in itself a tram; that it is automatic in its action, so that when set at work it will dress an entire stone without further attention; and that it does not require adjustment for each land on the stone. The latter peculiarity produces a perfectly plane face on the stone, as the face is made to conform to the fixed position of the principal vertical journal around which the arm carrying the cutter revolves; whereas if the base is changed during the dressing it must, more or less, be affected by the irregularities of the stone upon which it rests. The action of the Gilmore machine imitates therefore that of the lathe in working from fixed centers; and must not be confounded with that of any other millstone-dressing machine heretofore introduced in this country. The action of the machine will be understood by reference to the accompanying engraving, in which A represents the base of the machine set on three adjusting screws, B, for leveling the machine. This base supports a hollow, upright journal, C, which is inclosed by a sleeve, D, mounted on a suitable shoulder.



GILMORE'S REVOLVING DIAMOND MILLSTONE DRESSING AND FACING MACHINE.

The sleeve, D, is provided with a strong bracket, E, on the outer end of which is mounted the tool-supporting arm, F, having the power of making a horizontal sweep through the agency of a hinge joint not shown in the engraving. By this means the machine is enabled to execute a right or left hand dress as required. It will be seen that this arm is provided with ways, upon which the slide carrying the tool stock plays; the tool stock being pivoted to the slide at G. The fit, however, is made so tight that the tool stock is barely movable by the action of the screw, H, which screw is actuated by an arrangement of a ratchet-nut, lever, and pawl, I.

The action of the screw, H, is to give a slight rotation of the tool stock around the central pivot, G, whereby the end of the tool stock carrying the revolving cutters, J, is elevated or depressed to the depth required.

On one end of the arm, F, is formed a curved upright, K, for the support of the gear which imparts reciprocating motion to the sliding tool. This arrangement consists of a worm gear, L, actuated by a vertical screw behind K, and not shown in the engraving, which receives motion from the small grooved pulley, M, on the lower end of the screw. The pulley, M, receives motion from a small cord belt impelled by the grooved pulley, N, the cord belt first passing around the friction pulleys, O, placed over the hinge joint on which the arm, F, turns, so that when this arm is turned in any direction the cord is neither tightened nor slackened. The worm gear, L, imparts reciprocating motion to the slotted oscillating arm, P, which imparts motion to the tool holder in such a manner that when it backs out to make a new cut, it is raised enough to clear the face of the stone. In making the return stroke it is brought down to the work as positively as though it were screwed in a fixed position.

The revolving cutters are driven by a flat belt from the pulley, Q. The pulley, Q, receives motion from the grooved pulley, R, by a small cord belt passing over friction pulleys, in such a manner that the belt is neither tightened nor slackened by any motion of the arm, F, or by the reciprocating motion of the tool stock.

A presser bar, S, holds the machine in a fixed position by means of a vertical screw, and motion is given to the entire machine by means of a cord belt running from a grooved pulley, fixed to any convenient shaft.

A worm gear, rests on a shoulder, formed at the top of the journal, C, to which it is firmly fixed when the machine is at work. A worm, acting in this fixed gear, and actuated at proper intervals by a system of feed gear, gives the required radial feed.

We have found it difficult to describe this machine without giving it an appearance of complication which does not in reality attach to it. The whole arrangement is really very simple when one sees it in operation. The number of belts is only three—two cord belts and one flat belt. The arrangements of the cord belts, however, give a complicated appearance to the drawing.

The machine weighs only about one hundred pounds, and performs its work admirably, doing all that is claimed for it, as we can vouch from personal observation. It will dress a stone in from an hour to an hour and one half, according to the number of cuts per inch required, and the condition of the stone; and one man can attend two machines with ease. The cost of the carbon points is less than that of sharpening picks for the same amount of work, as is shown in the experience of those who have used them during the past two years.

The inventor informs us that revolving cutters were invented by him after ineffectual attempts to use the draw cutter in a machine which he patented but never attempted to introduce, in consequence of the defects in its operation, mentioned above as belonging to this class of machines. The effectiveness of the revolving cutters is something surprising, and the speed at which they are run is still more remarkable; the minimum speed being 15,000 revolutions per minute, and the maximum speed being 20,000. Twenty cuts from the skirt to the center of the stone can be made per minute, and the plane of the furrow can be dressed equally as true as the face. This cutter must, therefore, be regarded as the most effective tool known in the arts.

The present machine does all that is claimed for it, and the time lost in litigation has been improved in continuous efforts to bring the machine to the high point of perfection it has now reached. It now not only faces the stone to as perfect truth as a piece of metal or wood can be turned in a lathe, but it makes a dress by which it is said ten per cent more fine flour can be produced than with stones dressed in the old manner.

This machine is covered by a number of patents, extending from May 26, 1863, to Jan. 26, 1869.

A machine may be seen in operation at No. 23 Whitehall st., New York, where orders or letters of inquiry may be addressed to the inventor, Mr. J. T. Gilmore.

To Take Grease from Paper.—Gently warm the parts containing the grease, and apply blotting paper so as to extract as much as possible. Boil some clear essential oil of turpentine and apply it to the warm paper with a soft clean brush. A little rectified spirits of wine should be put over afterward.

[For the Scientific American.]

ON TUNGSTEN.

BY PROFESSOR CHARLES A. JOY.

Associated with tin occurs a black mineral of a partially metallic luster, sometimes in crystals of considerable size, to which the early miners gave the name of wolfram, from the German word *wolfrig*, because it behaved like a wolf among the other metals, and often appeared to devour them. Another mineral of a white color and extraordinary weight was also found in tin mines, and for a long time was looked upon as an ore of tin. Cronstedt called this mineral "tungston," meaning in the Swedish language heavy earth, and no wonder, for it has a specific gravity of six, and is heavier than many metals.

The renowned Swedish chemist Scheele decomposed this tungsten mineral in 1781, and found that it contained a peculiar acid associated with lime, and the mineral was afterwards called, in honor of its discover, "Scheelite."

The original black mineral known as wolfram was analyzed by two Spanish chemists named d'Elhujar, in 1783, who found that it contained the same acid as the scheelite, combined with manganese and iron. The question now arose, what name it would be wise to give to the new element, and Berzelius favored calling it wolframium, others preferred tungsten, and a few scheelium. The latter name has been dropped and a compromise effected between the others by generally calling the metal tungsten, while the symbol employed to represent it is W. Within five years some French chemists have announced that the so-called tungsten was a compound body made of several elements, and they claim to have prepared a series of salts, chlorides, and oxides, as different in their properties as would be the similar compounds of iron, nickel, or cobalt. The announcement is rather a startling one; but as the leading chemists of France have not adopted the new notion, we must still consider tungsten as entitled to be called an element.

Thus we have given the principal points in the history of this interesting metal, and may now say something about its occurrence.

Tungsten is a rare metal. The number of ores in which it is found is exceedingly limited, though one of them occurs in considerable quantity in a few localities.

The mineral tungsten (*tung*—heavy, *sten*—stone) or scheelite, is chiefly tungstate of lime, containing 78 to 80 per cent of the acid. It is found in Cornwall, Cumberland, South America, Bohemia, Saxony, Sweden, Connecticut, Massachusetts, North Carolina, and Nevada, and is usually associated with crystalline rocks in connection with tin ore, topaz, apatite, molybdenite, and wolfram, but is nowhere found in considerable quantity. The mineral wolfram is the tungstate of iron and manganese, and is found in much the same localities as mentioned above, and often in large quantities, so that it would become the chief ore of tungsten in the event of that metal being extensively used in the arts.

Cupro-scheelite, or tungstate of copper and lime, is described by Professor Whitney as occurring in California; other minerals are stolzite (tungstate of lead), tungstite (tungstic ocher), and Huebnerite (tungstate of manganese)—all of them exceedingly rare.

It is an interesting fact that the metal indium has been found associated with tungsten in wolfram.

METALLURGY OF TUNGSTEN.

The metal tungsten has been prepared in various ways not however in a fused state, but is a dark gray powder or as a brilliant mirror or glass.

Junot, in 1853, obtained tungsten by electrolysis of a solution of carbonate of soda, treated with oxide of tungsten, and saturation of the liquid with prussic acid, and addition of cyanide of potassium and boiling. Thus prepared it was a brilliant silver-white metal.

Woehler prepared the metal by passing a mixture of chloride of tungsten, and dry hydrogen gas through a heated glass tube. A specimen prepared in this way, and now deposited in the cabinet of Columbia College has the following properties: It forms on the glass a brilliant, steel-colored metallic mirror, from which it can be separated in thin leaves; it is brittle and very hard, and has the specific gravity of 16·54, which is considerably lighter than that afforded by the metal prepared in another way; heated strongly in the air it burns to the yellow acid; it is not attacked by ordinary acids, not even by aqua regia, nor by caustic potash, but is dissolved in a mixture of potash and hypochlorite of soda.

Riche, in 1857, prepared tungsten by passing hydrogen gas over the acid, heated strongly in a porcelain tube; it was in the form of crystalline grains, which assumed a metallic luster when rubbed, and were hard enough to scratch glass; it could not be fused in the highest heat of the iron furnace, but yielded to 200 pairs of Bunsen elements; it was soluble in acids after continuous action for several days. Water has no effect upon it.

Bernouilli, in 1860, reduced tungstic acid by charcoal, but was entirely unable to fuse the dark gray powder to a metal in furnaces that melted porcelain and Hessian crucibles. He found the specific gravity of the metal obtained in this way to be 17·1 to 17·3, and when reduced by hydrogen to be 17·9 to 18·2—this latter determination would place tungsten next to uranium in the order of specific gravity, as follows: osmium, 21·4; iridium, 21·15; platinum, 21·15; gold, 19·3; uranium, 18·4; tungsten, 18·20.

Attempts to alloy tungsten with other metals, such as copper, lead, zinc, antimony, bismuth, cobalt, and nickel, were generally unsuccessful, and produced mixtures that were infusible. Iron alone can be mixed in all proportions with tungsten, but where there is more than 80 per cent of the latter metal, the alloy is difficult to fuse.

At the London Exhibition of 1862, Versmann showed a small button of the pure metal, which he claimed to have obtained by exposing about an ounce of the powder to the strongest heat of a Griffin's furnace. In this operation no graphite or Hessian crucible was found to stand. The fusion was accomplished at last by heating the metal for three hours in a crucible made of freshly-burnt lime. Despretz also fused tungsten by the aid of a galvanic battery composed of 600 pairs of Bunsen elements, to a mass resembling steel in its fracture, and of a sufficient hardness to scratch ruby.

The specific heat of the metal, according to Regnault, is 0·03242. It is not magnetic, is crystalline in texture; is harder than steel, according to some authors, and according to others is malleable, ductile, soft, with the color and luster of gold. From all of these observations it will be seen that authorities differ in reference to this rare metal, and it is probable that the perfectly pure element has never yet been prepared.

THE USES OF TUNGSTEN.

We cannot do better, under this head, than to quote from the admirable "Treatise on Metallurgy," by Crooke's and Roehrig, just published by John Wiley & Son, where the authors discuss the properties of tungsten steel:

"It was long known that the celebrated Damascus sword blades contained tungsten (0·05 to 0·1 per cent), and De Luynes employed an addition of tungsten for the production of artificial damasked steel.

"In 1855, Jacob first produced tungsten steel experimentally on a large scale. The steel showed an exceedingly fine, conchoidal, silk-like fracture; it combined great hardness and density, and was superior in tenacity and weldability to all other steel.

"Next, tungsten steel was produced on a large scale at Leoben, and in different steel works of Germany, England, and France. A patent has been obtained for the manufacture of metallic tungsten alloys (including tungsten steel) by Mr. R. Oxland, as a communication from Messrs. Jacob and Koeller. The steel is prepared by melting with cast steel or even with iron only (at the puddling process), either metallic tungsten, or, preferably, what has been termed the native alloy of tungsten, in the proportion of two to five per cent. The native alloy is obtained by exposing to strong heat in a charcoal-lined crucible, a mixture of clean powdered wolfram with fine carbonaceous matter; it is a black steel gray, spongy mass, resembling metallic tungsten. The composition of the alloy is shown in the following statement of the composition of wolfram:

Tungstic Acid.	Oxide of Iron.	Oxide of Manganese.	
Tungten, 76·25	Iron, 17.75	Manganese, 6·00	—100·00
Oxygen, 19·06	Oxygen, 5·07	Oxygen, 1·71	— 25·84
			125·84

"Wolfram is sometimes used as an addition to the ore mixture for the production of pig iron. According to Bernouilli, when an intimate admixture of finely divided gray cast iron and tungstic acid is heated to a very high temperature, the graphitic carbon is burnt by the oxygen of the tungstic acid and steel is formed, which alloys with the reduced tungsten. No diminution in the amount of carbon was, however, perceptible when the experiment was repeated with spiegeleisen, or ordinary cast iron, carbon in the combined form being apparently unable to effect the reduction of tungstic acid. Siewert examined eight samples of so-called tungsten steel; the following analyses show that the samples contained no tungsten:

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Iron........	—	—	95·55	—	96·37	—	—	—
Tungsten...	1·05	2·84	3·05	—	2·71	—	4.75	0·9
Manganese..	—	—	—	—	(trace)	—	—	—
Carbon.....	—	—	—	1.04	—	1·03	—	—

"No. 1 is tungsten steel from Vienna. Nos. 2, 3, 4, 5, and 6, such steel from Bochum. No. 7, hard tungsten steel from Döhlen. No. 8, soft tungsten steel from Döhlen.

"It is frequently maintained that tungsten steel, owing to its superior qualities, is particularly adapted for the manufacture of cutting tools, swords, and the fine machinery of watches, and that a small addition of it would improve the inferior kinds of steel. Appelbaum found the tungsten steel inferior to Huntsman's steel, but superior to common English cast steel; it could also be more easily welded without the application of artificial fluxes, and on hardening required a higher temperature than the English cast steel before cooling. Notwithstanding its reputed qualities, tungsten steel has not been generally introduced, probably owing to the high price and the scarcity of wolfram. Perhaps steel was sold as tungsten steel which did not contain any tungsten, or else its reputed qualities are somewhat exaggerated."

According to Siemens, if tungsten be mixed with iron or steel, the magnetic power of the metal is greatly increased. A one pound ordinary horseshoe magnet will sustain seven pounds, while a tungsten steel magnet of the same weight, will sustain twenty pounds. He also claims that the tungsten steel retains the magnetic property longer than the metal usually employed. This discovery points to the use of tungsten steel for magnetic needles and for magneto-electric machines, and in the manufacture of telegraphic apparatus and is one that ought to be more fully investigated.

Captain Caron, the amiable and accomplished engineer in charge of the Museum of Artillery in Paris, was kind enough to communicate to us the results of his experiments upon the alloys of tungsten, and to contribute some specimens for the cabinet of Columbia College. Although he had a furnace capable of melting steel with the greatest care, he was unable to fuse tungsten to a homogeneous button, and the specimen he gave to us was in the form of a dark gray powder. M. Caron found that the addition of tungsten increased the toughness of metal employed in the manufacture of rifles; it also imparted great hardness to steel. His efforts to produce better bronze and cannon metal were unsuccessful, as tungsten will not alloy with copper, tin, and gun metal, notwithstanding patents have been taken out in England for this purpose.

By fusing cement steel with five per cent tungsten he obtained a regulus so hard that turned steel was blunted in contact with it; the alloy was, however, malleable. M. Caron at that time (1865) seemed to think that tungsten steel was destined to become an important article of manufacture—a prediction that has not been fulfilled, as in the Paris Exhibition of 1867 we did not find this article playing the part that its friends had anticipated for it; tungsten colors, however, were largely represented, as were many of its salts, the uses of which are becoming better known, and may serve as the basis of a future article on this subject.

Previous articles on tungsten may be found in the SCIENTIFIC AMERICAN, New Series, Vol. III., 1860, pages 256 and 309; Vol. X., 1864, page 105.

[For the Scientific American.]

CIRCULATION OF WATER IN STEAM BOILERS.

BY CHAS. E. EMERY, ENGINEER.

If heat be applied to the bottom of a glass flask, which has been partly filled with water, containing a little bran, it will be seen that the water rises at the center, as its gravity is reduced by heat, being displaced by colder water, which flows downward along the sides and in at the bottom, and is there heated and crowded up in turn by cooler particles, so that all the water quickly becomes heated, and after a time reaches the state of ebullition, when the surplus heat passes off in steam, and the water currents continue as before. This movement of the water is known as "convection" or "circulation," and must exist in some form in all apparatus designed to heat fluids. If the bottom of a flat shallow pan, containing water, be heated uniformly at all points, the heated water and bubbles of steam will rise directly to the surface, and the cooler water can only find its way back between the bubbles, which is so difficult that if the heat be forced, the whole mass of water will be raised into foam, and the pan will "boil over." This is an example of retarded circulation. Similar action often takes place in steam boilers of bad design. The water is displaced from some part of the heating surface by bubbles of steam which, in extreme cases, become so hot as to allow the sheet to be overheated, and when the circulation is dull the steam bubbles prevent free access of water to the heating surface, so that its efficiency for producing steam is greatly reduced.

Circulation in a steam boiler is then an absolute necessity, and to secure it provision must be made for both ascending and descending currents. We propose to show also that it is necessary that these currents should have separate channels so as not to conflict with each other. Take the simplest plain cylinder boiler. If the fire be applied underneath, the water will rise in the center and flow down at the sides the same as in the flask, but if the heat be spread around the whole of the shell below the water line, it is easy to see that the ascending bubbles at the sides will hinder the down flow at that point and the circulation be, to say the least, retarded. Indeed it is not difficult to imagine that the heat would occasionally be so applied as to reverse the currents and cause the steam and hot water to move outward up the heated sides and the colder water to fall down in the middle. To secure this action is the object of a late foreign invention, which consists in putting within and below the water level of a boiler a concentric sheet-iron shell, which directs the currents up the heated sides and permits the water to return through large pipes attached to the middle of the shell—the space about the pipes forming a still-water reservoir for the collection of deposits.

In cylinder boilers containing tubes the water and steam rise between the tubes and move not only to the sides but also to the cooler rear end of the boiler; and then down the sides, and along the bottom till sufficiently heated to again rise. This has been proved by experiments. A similar action takes place in the Harrison cast-iron boiler and in the Babcock and Wilcox sectional boiler. In the Gerner boiler the steam and heated water rise and pass to the rear around an interior steam chamber, and the rear of the boiler being larger the water rises and flows to the front as it is heated with great velocity.

The drop flue boiler has been a favorite with many engineers, from the fact that the products of combustion descend from one series of flues through two others in the same boiler before reaching the chimney, and thus the coldest gases heat the coldest water—a fine theory, which fails to give any practical advantage from the fact that the system prevents proper circulation unless the boiler be forced to its utmost. These boilers give trouble also from unequal expansion—being hot at the top and cold at the bottom.

In marine boilers a passage for the descending water currents is provided by separating the nests of tubes which belong to each furnace. In the Hicks vertical boiler the ascending and descending currents are kept separate by surrounding the tubes inside the boiler with a short jacket, the water flowing over it and passing between it and the shell of the boiler and entering the tubes beneath it.

A number of boilers are made of tubes sealed at one end and opening at the other into a suitable chamber. In some cases the tubes are set vertically with the sealed ends downward, the circulation being secured by an internal pipe to carry down the cooler water. The fire-engine boiler of a Seneca Falls company, in New York State, is made in this way. On a similar principle Miller makes a boiler in which the tubes are inclined and the inner tubes are supplied from the

front side of a diaphragm in which they are secured and which separates the two currents—the steam and heated water coming out around the inner tube and rising to the surface of the water, and the cooler water going down the other side of the diaphragm, and entering the inner tubes. Two of these boilers are in use at the Beach Pneumatic Tunnel under Broadway, in New York city. Sargent has a similar boiler in which each tube is divided into two parts by a diaphragm running its full length. The eldest boiler of this form was probably made by the German engineer Alban, who used some ingenious means to separate the circulating currents in the connecting chamber, but left them to take care of themselves in the tubes.

BOILER INCRUSTATIONS.

[Condensed from the Engineer.]

Incrustation is injurious in three distinct ways: It increases the consumption of fuel, it injures the boiler, and can even compromise its safety. Incrustation less than one eighth thick allows the passage of only one quarter of the heat it would if the plate were clean. One way in which incrustation injures the boiler is by its requiring the fires to be forced, thereby furthering the oxidation, diminishing the strength, and tending to tear away the plates of the boiler. The very cleaning of the boiler tends to injure the plates and structure. The cleaning of the boiler of a large steamship costs from fifty to sixty pounds in labor alone. At the same time, there is no doubt that a thin incrustation protects the surfaces of the plates against corrosion, and that it often closes up the joints and prevents escapes.

The foreign matters contained in the water can be divided into three kinds: Those that remain insoluble and in suspension, forming a non-adhesive mud, which only incrustates on highly-heated surfaces. Secondly, the salts soluble in water, such as, for instance sulphate of potash, and the chloride of calcium, and the chloride of sodium, found so abundantly in sea water. These remain in solution, and only form deposits when in considerable quantities in the water; and this can be prevented by blowing off. The third class consists of substances relatively little soluble in water, such as carbonate of lime and sulphate of lime. With these, this degree of saturation is soon attained, and they are deposited in the boiler, either in powder, which falls into the interior parts, or in crystals covering the wetted surface. The soluble salts can thus be got rid of by simply renewing the water; the muds produced can be taken away pretty easily by washing; but the incrustations produced by this successive precipitation of insoluble, or only slightly soluble, salts can only be got off by the hammer and chisel. This is generally true, but the relative quantities present in different kinds of water modify these results.

It is a fallacy, exploded forty years ago, that explosions are produced by the sudden contact of the water with the red-hot plates, on the cracking off of the incrustation, causing either "an enormous development of steam," or "decomposing the water with an attendant disengagement of a great quantity of hydrogen."

The means of encountering incrustation are of two main kinds: The water can be purified before being fed in, or different apparatus, applied inside the boiler, can be used for the purpose. Before feeding it in, water can thus be purified by (1) chemical reactions; (2) by heating it; (3) it can be distilled by using the condensed steam as feed-water. In the case of the presence in the water of carbonate of lime, held slightly in solution in the form of bicarbonate, the state of solution being aided by the presence of a slight excess of carbonic acid, by saturating, by means of a sufficient quantity of lime, the excess of carbonic acid, the greater portion of the neutral carbonate will be deposited on account of the very slight solubility of that salt. This plan has been used in England, and also especially by the French Orleans and the North Railway companies. Carbonate of soda can also be employed for the preliminary purification of some waters. It is largely used in some of the Lancashire districts, but it has the inconveniences of causing priming and of favoring leakages.

As the carbonate and sulphate of lime are very slightly soluble at 120° or 130° Cent., and nearly absolutely insoluble at 140° to 150° Cent., the water can be sometimes purified by heating it. The feed-water heater adapted by M. Belleville to his water tube boilers, in order to prevent their being filled up with incrustation, works on this principle. The water, forced in by a pump, is thrown from below against the top plate of a large vertical cylinder, which communicates at the top with the steam collectors of the boiler, and at about the middle of its hight with the water collector. The water injected falls in rain into a chamber wherein flows the steam, on a plate partly occupying the transverse section of the cylinder. From thence it flows into the water reservoir, the level of which is about the same as that of the boilers. The water is heated to nearly the temperature of that in the boiler, and the salts dissolved are precipitated to the bottom of the cylinder, whence they are from time to time blown out.

As regards marine boilers, blowing off with low-pressure and surface condensation in tubular high-pressure boilers, are the only methods now used in practice to encounter incrustation. It is thus mainly in marine engine work that surface condensers have been adopted, though their success at sea is slowly leading to their use on land.

The processes employed within the boiler consists in—(1) blowing out; (2) mixing the water with substances modifying the incrustations either chemically or mechanically; (3) employing the circulation of the water for extracting the matters in suspension; (4) applying electricity against the incrustations. In the Imperial Marine the boilers are continually blown out. As regards the different substances introduced, a volume could be written about them, so numerous are they. In France very good results in preventing solidification have been obtained by the use of logwood shavings. The steam, though the boiler does not prime, is of a violet color, no doubt from its taking up a little water. Logwood is also employed in a liquid composition used on the Orleans Railway. One of the most legitimate means, because inexpensive and obtainable by construction, for getting rid of boiler deposits, evidently consists in utilizing the circulation and the natural tendency of heavy substances towards the bottom. Merely setting the boiler to a slight incline from the fire is, as we know, often very effective; and a conical vessel riveted to the bottom at a spot chosen for its slow circulation is often very useful.

The action of Baker's electric anti-incrustator is very capricious in preventing the solidification of incrustation. It is clear that it acts by electricity, and not magnetism; and evidently by frictional electricity, produced by the friction of the steam on the points of the star. Nothing should be neglected to obtain good feed water; and the chemical qualities of the water to be used should be determined before the form of the boiler to be used is settled upon; then the mode of getting rid of the incrustation is to be chosen—treating the water before its introduction into the boilers being almost always the best method.

[For the Scientific American.]

THE HOME OF THE PERFUMES.

We are in the south of France, on the coast of the Mediterranean, where the three cities of Nizza, Grasse, and Cannes form a sort of triangle. A rich, but yet a light soil; to the north, a range of mountains, which shut out of the cold blasts of north winds—these advantages, combine with a soft sky resembling that of Italy to make this the most charming and the most fertile part of France. It is, therefore, with a true national pride that the peasants of this district are wont to say: "Plant a walking-stick, and a flower will bloom from its handle."

Plants, which everywhere else are cultivated in gardens as ornaments, form here the main product of the soil. There are no gardens here, for the entire district is a bed of fragrant flowers. The jessamine, the tuberose, the orange blossom, the daffodil, the rose, the acacia, and many other plants are bud and bloom almost the year round. The exuberance of these lovely children of Flora affects the character of the inhabitants as well as their mode of living. A stranger is affected by the fragrance as if drugged by some narcotic.

The culture of these flowers is almost the exclusive occupation of the peasants. During the summer months all hands are busy among the flowers—weeding and watering. Old and young are occupied in gathering the leaves of flowers, of which it takes so many to make a pound.

The following statistics will show to what extent this business is carried on: The product of one year has been 1,475,-600 lbs. of orange blossoms, 530,000 lbs. of roses, 100,000 lbs. of jessamine, 75,000 lbs. of violets, 45,000 lbs. of acacia, 30,000 lbs. of geranium leaves, 24,000 lbs. of tuberoses, 5,000 lbs. of daffodils, besides a large quantity of lavender, and many other flowers.

The quantity of perfume contained in this mass of leaves may be imagined, yet the peasants themselves do not understand the art of extracting the delicate odors from the flowers, among which nature has thrown them, and it is the chemist who has to continue the work. Thus we behold in the midst of these fields of flowers the signs of modern industry, the numerous tall chimneys of the different laboratories. It is the same here as everywhere else; the first producer has to content himself with but a small profit; and the landowners consider it a good business if they receive from the chemists one third of the total profit.

In these laboratories every spark of poetry connected with the beauty of flowers disappears. The leaves are turned into a solid mass; the balmy essence takes the place of the emblematic interpretations—a chemical process has finished the work.

Oils or greasy substances are impregnated with the odoriferous elements of the flowers by three different operations. Two of these depend upon the fact that oils or fats brought in contact with the flowers, absorb and retain their fragrance. If afterward these perfumed fats and oils are thrown into pure alcohol, the latter extracts the perfume from the oils or fats, and thus an essence is obtained.

These two methods of working are called in France "enfleurage" and "maceration." For the process of "enfleurage" a sort of a frame with shelves is used. Between the wooden shelves are glass tablets, upon which the purified fat is spread. Upon these are laid the fresh-picked flowers. Some forty to fifty of these shelves are piled up and left for twenty-four hours, after which time the old flowers are removed, and fresh ones put in their places. This process is continued until the fat is sufficiently impregnated with the odoriferous principle of the flowers; then the fat is melted from the glass at a moderate heat, and separated from the leaves which may have adhered to it, after which it is packed in jars and boxes, and is then ready for exportation.

"Maceration" is performed by soaking the flowers for a certain length of time in the fat or oil. Practice has shown that not all flowers will yield their perfumes in this way; some discharging their perfume with more facility than others. The acacia is particularly adapted for "maceration."

Of late years another process has been introduced, consisting in treating the flowers with various ethers, etc., but it is not yet in general use. Lastly, the odor of some flowers is obtained by distillation; but delicate odors are injured or dispersed by this operation.

The essence of orange blossoms obtained by "enfleurage" is far superior to that gained by distillation. Lavender is almost the only plant which does not loose by distillation.

Extracts obtained through "enfluerage" or "maceration" are the condensed odors of the living flowers, while by distillation we obtain only a second-class perfume.

It has been a question of considerable importance how to obtain the extracts of flowers of tropical countries. Experiments have been made in Algiers, but without favorable results. However pure the fat or oil used may be, it soon turns rancid in a hot climate. If the process of etherizing is brought to perfection, the flower culture of the south of France will doubtless diminish, for the tropics of America alone would furnish enough perfume to supply the entire western hemisphere. I. C.

How to Cure a Cold.

Dr. G. Johnson, Professor of Medicine in King's College, London, in a recent lecture gives the following cure for a cold:

"The popular domestic treatment consists in the use of a hot foot-bath at bed time, a fire in the bed room, a warm bed, and some hot drink taken after getting into bed, the diaphoretic action being assisted by an extra amount of bed clothes. Complete immersion in a warm bath is more efficacious than a foot bath; but the free action of the skin is much more certainly obtained by the influence of hot air—most surely and profusely, perhaps, by the Turkish bath. The Turkish bath, however, is not always to be had, and even when available, its use in the treatment of catarrh is attended with some inconvenience. In particular, there is the risk of a too speedy check to the perspiration after the patient leaves the bath. On the whole, the plan which combines the greatest degree of efficiency with universal applicability, consists in the use of a simple hot air bath, which the patient can have in his own bed room. All that is required is a spirit lamp, with a sufficiently large wick. Such lamps are made of tin, and sold by most surgical instrument makers.

The lamp should hold sufficient spirit to burn for half an hour. The patient sits undressed in a chair with a lamp between his feet, rather than under the chair, care being taken to avoid setting fire to the blankets, of which an attendant then takes two or three, and folds them around the patient from his neck to the floor, so as to inclose him and the lamp, the hot air from which passes freely around the body. In from a quarter to half an hour there is usually a free perspiration, which may be kept up for a time by getting into bed between hot blankets. I have myself gone into a hot air bath suffering from headache, pain in the limbs, and other indications of a severe incipient catarrh, and in the course of half an hour I have been entirely and permanently freed from these symptoms, by the action of the bath.

Another simple and efficient mode of exciting the action of the skin consists in wrapping the undressed patient in a sheet wrung out of warm water, then, over this, folding two or three blankets. The patient may remain thus "packed" for an hour or two, until free perspiration has been excited."

A Milwaukee Steam Engine.

If our memory serves we have before heard of something like the following attempt of a Milwaukee inventor to avoid the use of the crank in steam engines. The papers of that city are making predictions that it will work a revolution in steam engineering. We copy the following description from the *Daily Milwaukee News*.

"The engine is very simple, and consists of a cylinder 12 inches long and 6½ inches bore (in the one already built), with the shaft passing through the center of it. The cylinder is furnished with a piston at each end, precisely like the pistons of common crank engines; to these pistons are connected short rods, with a friction roller at the outside end working in the inside of an elliptical ring, which passes around the shaft outside of the cylinder; outside of the ellipse is another friction roller, connected to the piston by compensating levers in such a manner that when the pistons are moving towards the center of the cylinder, the rollers act on opposite sides of the ellipse, both pulling directly towards the center, thus causing them to move forward on the ellipse, and communicating a rotary motion to the shaft. After the rollers have passed forward to the shortest diameter of the ellipse, the steam is exhausted from the ends of the cylinder and let into the middle, between the pistons, pressing them outward, causing the rollers in the ends of the piston rods to act on the inside of the ellipse, and continuing the forward motion of the shaft until they arrive at the long diameter, when the steam is exhausted from the middle of the cylinder, and is again applied at the ends. The results obtained were surprising, and can hardly be credited by believers in the infallibility of the crank motion. The cylinder is about the size of the cylinder of an eight-horse crank engine, with a stroke of three inches for each piston, and the power evolved was at least 22-horse power, and some present at the trial placed it as high as 25-horse power, with a speed of 100 revolutions per minute, and 50 pounds of steam, consuming about the amount of fuel required for a 10-horse engine"

TO CLEAN OLD BRASS WORK FOR LACQUERING.—First boil a strong lye of wood ashes, which you may strengthen with soap lees; put in your brass work, and the lacquer will immediately come off; then have ready a pickle of aquafortis and water, strong enough to take off the dirt; wash it immediately in clean water, dry it well and lacquer it

THE NEW GRAND OPERA HOUSE, PARIS.

So much has been said and written about this remarkable structure, that our readers will be interested in the view of the building we give herewith. It was designed by M. Garnier, a young architect, who by this work has achieved a world-wide fame.

The building has been justly characterized as the finest architectural work of modern times. The view we give of it does not, however, give an adequate idea of its magnitude. The view is that of the façade, and the smaller engravings show some of the details of ornamentation.

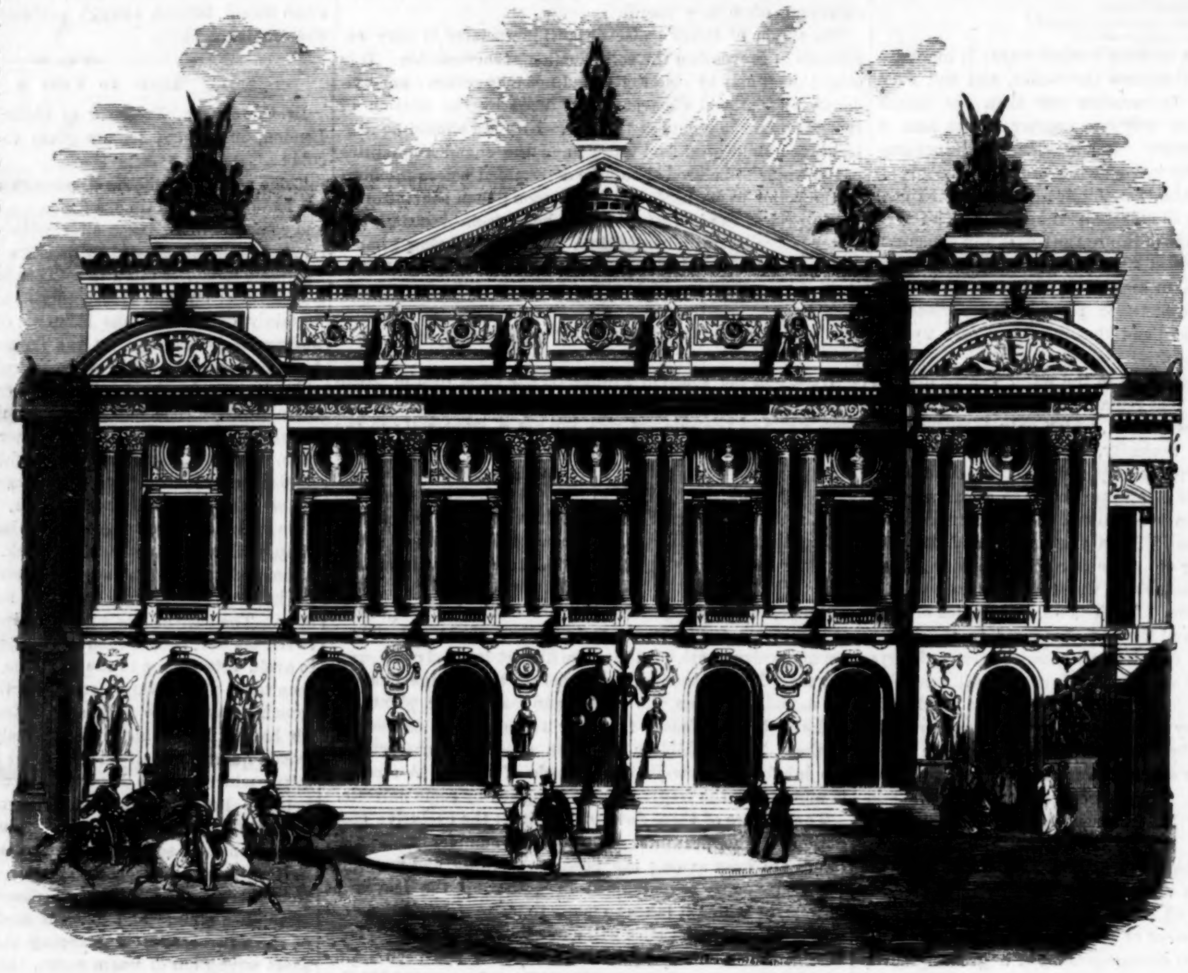
The general plan of the building is that of a rectangle, 574 feet in depth by 196 in width. Its cost has been estimated at $8,000,000, one half of which was defrayed by the French Government, and one half by the municipality of Paris.

The order of architecture M. Garnier has chosen is Corinthian. In the basement there are five main arched entrances approached by a broad flight of steps, and two more at the wings which open upon the street level; between the doorways the wall is enriched with groups of statuary, and heads carved in relief upon medallions, wreath encircled, and with the name of the original below each medallion—the names of the great masters of music.—Above the basement rise eight pairs of Corinthian columns, executed in white stone. The intervening bays are occupied, each, by a window opening upon a gallery, the top of whose balustrade coincides with the bases of the columns. The gallery is available as a promenade. Smaller columns between the large range reduce the width of the windows, and support minor entablatures, with circular recesses containing each a gilded bust of a great musician. At the wings the larger columns support circular pediments, which are filled with sculptured groups in relief. The cornice over the row of main columns, extending along the whole frontage of the building, has inscribed upon it in gilded letters the words "Chorographie" and "Harmonie" upon each of the wings—upon the body of the building, "Académie Impériale de Musique." Above the cornice rises a deep frieze, bearing four groups of figures immediately over the columns supporting circles, within which the initial of the Empress is inscribed, the intermediate panels being enriched with a circular wreathed medallion filled with the letter N. The top of the frieze is completed with a series of classic masks, representing Tragedy and Comedy alternately, cast in bronze, and gilded. The wings of the building are surmounted with groups of statuary, at one end the Genius of Poetry, at the other the Spirit of Music. Above the frieze in the center of the building, and crowning the body of the theater, rises a decorated dome, whilst is seen a pediment forming the one face of a large roof which covers the stage and offices of the building. The apex is surmounted by a group, of which Apollo forms the central figure, whilst at the springing of the pediment stands on each side the presentment of Genius curbing in a rearing Pegasus.

On the side elevations of the opera house, the architectural details which characterize the façade, are preserved, the line is broken below by the presence of a semicircular pavilion on each of the lateral frontages. Here, too, is seen the side elevation of the large roof spanning the stage, so that a totally different aspect to that of the main façade is obtained. At the rear there is but a small pretense to architectural effect.

Every part of the building is fire-proof. The walls and staircases are of stone, the columns—five hundred in number—supporting them and the tiers of boxes are of marble from Mont Blanc. All that in an ordinary building would be of timber—the carpenters' work—is of iron. The only inflammable material will be the scenery—easily separable from the auditorium and its dependencies—and the paneling and drapery of the boxes. An alarm of fire—from which, even if proved false, such frightful results have ensued in public places—will certainly be accompanied by the minimum of danger, so numerous and capacious are the outlets.

The ceiling will, when finished, be composed of a vast number of plates of copper screwed one to the other in such a way as to be easily put together and taken to pieces again, and thus permitting the ceiling to be raised or lowered at will. The whole is divided into several sections, which are now being painted with allegorical representations of the hours of day and night, more than a hundred figures being included in the whole. The place in which the artist carries on his labor is situated in the grand cupola over the pit, and forms an immense rotunda, 120 feet in diameter, and 65 feet in hight.



NEW GRAND OPERA HOUSE AT PARIS.

The Invention of the Art of Printing.

The *Typographic Messenger* says: "While the majority of bibliographers concede to Gutenberg, of Germany, the inestimable honor of inventing printing from movable types, there are many others who contend that to Koster, of Holland, is due the merit of the invention, and that Gutenberg was but an improver upon Koster's idea. This difference of opinion has led to much investigation into the merits of the respective claimants for this distinguished honor, and the work of Mr. Humphreys', including, as it does, the latest facts on the subject brought to light, seems to indicate strongly that to Holland the world is indebted for the birthplace of the wonderful 'art preservative of all arts.' Copies of a work entitled the 'Speculum Humanæ Salvationis' (the Mirror of our Salvation)—claimed to be the first book ever printed in which movable types were employed—are still in existence, and are said to have been the production of Koster about the year 1430. This date has been arrived at from cotemporaneous circumstances bearing upon the subject, and which, if correct, places Koster's right in the matter many years prior to Gutenberg's earliest attempts towards the perfection of the invention.

"In disputing that Koster was the originator of the art of printing from movable types, some of the supporters of Gutenberg, while admitting that Koster issued the 'Speculum Humanæ Salvationis,' have contended that it was a block book, as Koster's occupation, previous to 1430, was that of engraving and printing such books; but a careful examination of the work in question has shown that fac-simile defects in particular letters have been detected throughout the entire work. A single instance, too, of an inverted letter, and several typographical errors in the substitution of similarly shaped letters for the correct ones (a fault that has been faithfully copied by too many of the latest imitators of their celebrated predecessor), show that the 'Speculum Humanæ Salvationis' could not have been an engraved book, or these discrepancies would not have been made.

"It is supposed that the first efforts of Gutenberg to introduce the invention of printing from movable types into Germany, took place at Mayence about the year 1436, although it does not conclusively appear that any productions of his press were issued previous to 1455 or 1546, the probable date of the publication of his Bible. It is reasonable to infer, however, that before the completion or even the beginning of that great work, minor experiments were made to demonstrate the success of his enterprise.

Koster's supporters agree that Gutenberg received his first knowledge of printing from movable types from a workman (thought by some to be Fust), who had left Koster's service in Holland, and fled to Germany with tools and specimens of the workmanship of Koster. The mechanical excellence of Gutenberg's productions being so much superior to the earlier efforts of Koster, it is not improbable that in the material progress and success of the art in the hands of the former, Koster's still greater originality was soon lost sight of.

"While Gutenberg's name is more prominent than those of his associates, Fust and Schoiffher, as the master-mind of their great undertaking, it is more than likely that his stupendous work, the Bible, was issued by the latter two; it appearing that his interest in the business was brought to a lamentable termination by the foreclosure of a mortgage held against him by John Fust (Gutenberg's partner, and thought by some to be the uncle of Fust, Koster's work man), for moneys advanced to further and complete his ideas, and that Gutenberg, having up to the time of the foreclosure received no profit from his labors, was forced to retire just as his noble work was on the eve of a glorious consummation. It matters little whether to Koster or Gutenberg is due the credit of the most valuable invention ever produced for the elevation of the human race; but the genius of Gutenberg, as displayed in his wonderful achievement of the first Bible printed from movable types, is bound to perpetuate his name and works until printing is no more."

ACCORDING to a recent author, iridium, as used in coloring glass and porcelain, gives a tint of such intense blackness, that if charcoal does not make a white mark upon it, all other blacks appear brown by the side of it.

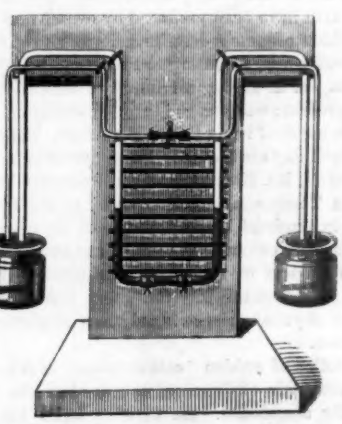
THE caisson for the Brooklyn end of the East River Bridge was successfully launched on Saturday, March 19, and will soon be in position.

A HOME-MADE DIFFERENTIAL THERMOMETER.

In the proceedings of the British Pharmaceutical Conference for 1868, Dr. Matthiessen's Improved Differential Thermometer with pendent bulbs is described and illustrated. This instrument is adapted for illustrating many fundamental facts relating to heat, and is now commonly employed in lecture experiments by our leading chemists and physicists.

We have much pleasure, says the *Chemist and Druggist*, in calling the attention of chemical students to a simple but effective modification of Matthiessen's thermometer, in which two wide-mouthed bottles and a few pieces of glass tubing are made to serve the purpose of the costly work of the glass-blower. The construction of this home-made apparatus is plainly shown in the following engraving.

The small bottles represent the glass bulbs of the original instrument. Each of these bottles is closed by a sound cork, through which two glass tubes pass. These tubes are bent into a series of angles by the aid of a gas flame, and their free ends are connected by pieces of india-rubber tubing. The ends of the smaller glass tubes do not meet, and their india-rubber connecting piece is furnished with a pinch-cock. The two wider tubes are also connected by a piece of india-rubber tubing. This joint is made merely to avoid the difficulty of bending a single length of glass tubing into the required form. Some colored liquid is introduced into the central portion of the main tube, and the whole arrangement is attached to a wooden stand bearing a scale formed of dis-



tinct horizontal lines. The hight of the apparatus is 1 foot 7 inches; the greatest width, 1 foot. Two-ounce bottles are used for the air vessels, and they are supported at the hight of about 5 inches from the ground, the main tubes rising 10 inches above the corks.

The instrument will not indicate general changes of temperature, but only differences between the temperatures of the two air vessels. If one of the air vessels is exposed to a higher temperature than the other, the air contained in it expands, and drives the colored liquid in the tube towards the cooler vessel. The relative hights of the two columns of liquid in the vertical portions of the tube are plainly indicated by the scale attached to the stand. By opening the pinch-cock, the pressure upon each column of liquid is equalized, and the level is thus adjusted for a new observation without loss of time.

The following instructive experiments, which our younger readers may repeat with profit, will illustrate the use of this sensitive instrument in physical research:—

LATENT HEAT.

I.—*Disappearance of Heat during Liquefaction.*—Place the air vessels of the thermometer in two tumblers containing water at the ordinary temperature. Having noticed that the level of the colored liquid is undisturbed, throw into one of the tumblers some sodium sulphate (Glauber's salt). The solution of the salt is attended by a reduction of temperature, which is at once made evident by the movement of the colored liquid towards the cooler vessel.

II.—*Latent Heat of Water.*—Fill a vessel with coarsely-powdered ice, and allow it to stand in a warm room until much of the ice has melted. Place the air vessels of the thermometer in tumblers containing equal quantities of luke-warm water. Then add to one portion of the warm water a weighed quantity of the unmelted ice, and to the other portion an equal weight of the ice-cold water. The rapid rise of the colored liquid, in the vertical portion of the tube next the tumbler containing the ice, will prove that a given weight of ice has a much greater cooling effect than an equal weight of ice-cold water.

III.—*Evolution of Heat during Solidification.*—By slowly cooling a solution of sodium sulphate, saturated at a high temperature, it is possible to obtain a cold supersaturated solution, which will crystallize suddenly on agitation. On plunging one of the air vessels of the thermometer into such a solution, which has been cooled down to the temperature of the surrounding air, the evolution of heat during the crystallization of the salt will be manifested by the movement of the colored liquid towards the cooler air vessel.

These three experiments illustrate fundamental facts relating to heat. When matter passes from the solid into the liquid state, heat disappears or becomes *latent*, and ceases to affect the thermometer; in other words, *sensible heat* is converted into *potential heat*. Conversely, when a liquid becomes solid, its potential heat is reconverted into sensible heat.

SPECIFIC HEAT.

IV.—*Oil and Water.*—Into two tumblers introduce equal quantities of warm water, and test the equality of temperature in the two portions by means of the thermometer. Now add to one portion a given weight of cold water, and to the other portion an equal weight of cold olive oil. Mix the liquids by moving the thermometer up and down. The mixture of oil and water will be found to be warmer than the water, although its bulk is sensibly greater. [The greasy bottle should be cleaned with a little benzole after this experiment.]

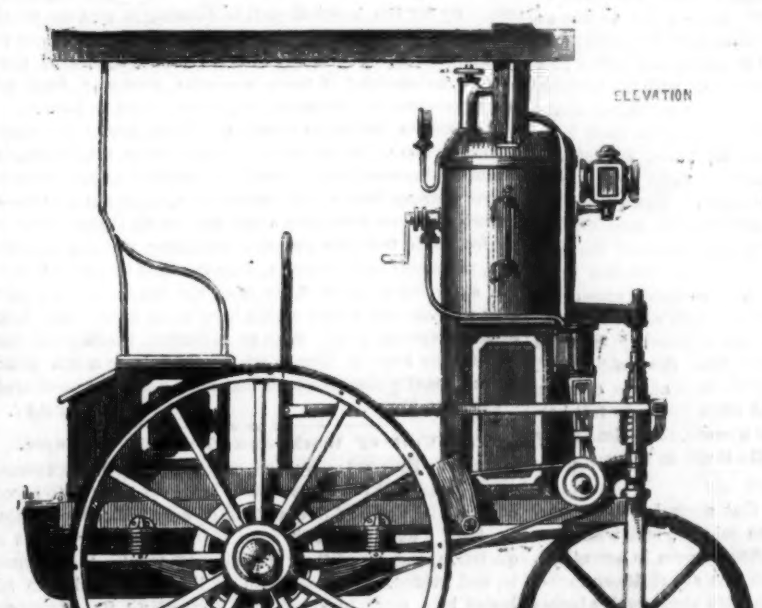
V.—*Zinc and Lead.*—Take equal weights of zinc and lead attached to threads, and having raised them to the temperature of 100° C. by immersion in boiling water, plunge them for a few seconds in equal bulks of cold water contained in two tumblers. On placing the air vessels of the thermometer in the tumblers, the movement of the indicating liquid will show that the zinc in cooling has parted with more heat than the lead.

VI.—*Relation of Combining Weights to Heat.*—Repeat the last experiment, but instead of taking equal weights of zinc and lead, take weights having the ratio of the combining weights of these metals (Zn=65, Pb=207). On plunging the air vessels into the tumblers of the warmed water, there will now be no disturbance of the indicating liquid; in other words, the thermometer proves that 65 parts of zinc and 207 parts of lead evolve sensibly the same amount of heat in cooling through a given range of temperature.

The last three experiments illustrate very forcibly the difference between heat and temperature. The temperature of a body affords no indication of the actual quantity of heat it contains. A pint of water may raise the mercury of an ordinary thermometer to the same degree as a gallon of water, but it is obvious that the larger volume of the liquid contains the greater amount of heat. Equal weights of different substances, in undergoing a similar alteration of temperature, evolve or absorb very different quantities of heat. These quantities of heat, expressed relatively to the quantity required to raise an equal weight of water from 0° to 1° C. are called the *specific heats* of the various substances. Now the specific heat of olive oil is much lower than that of water, consequently, in Experiment IV., the oil robs the warm water of comparatively little heat, and the resulting temperature of the mixture is higher than that of the mixture of warm and cold water in the other tumbler. Again, the specific heat of zinc is much greater than that of lead, consequently the mass of zinc used in Experiment V., gives out more heat in cooling than the mass of lead. The last experiment illustrates the important chemical fact that the combining weights of the elements are comparable quantities in their relations to heat. Thus, 23 parts of sodium, 108 parts of silver, 65 parts of zinc, 207 parts of lead, and 210 parts of bismuth, give out or absorb sensibly the same quantities of heat in passing through the same range of temperature.

ONE-HORSE ROAD STEAMER TO CARRY TWO PERSONS.

In the annexed engraving we give a design by Mr. L. J. Todd, Leith, for a little road steamer or steam velocipede, which will interest many of our readers. The main frame consists of a single angle iron. The boiler contains three



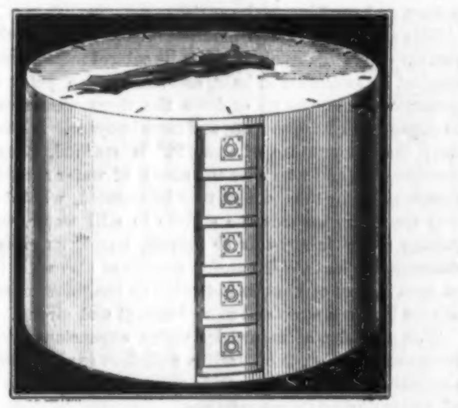
quarters of a square foot of grate surface, and about 16 feet of heating surface. The coal bunkers are situated on each side of the boiler. The driver's seat is made long enough to contain two persons, and is hinged at the top to form a locker inside. There is a tool chest at the back of the seat with hinged lid. The water tank is placed below the frame, and has a filler standing out behind. The driving wheels are four feet in diameter, and have steel tires one quarter inch thick; on to the boss of each driving wheel is fixed a grooved driving pulley fourteen inches in diameter. The main axle is cranked to clear the tank, and each driving wheel runs loose on it. The main bearing springs are fitted with rubber washers; there is also a brake on each wheel worked by a foot lever. On the main frame, to the forward side of each bunker, are fixed two plummer blocks which carry a double-throw crank shaft. The steam cylinders two and a half inches diameter by four inches stroke, are fixed to the top of each bunker; there is no reversing gear, but a single eccentric working forward and cutting off at five eighths. On each end of the shaft is fixed a friction cone carrying a grooved pulley six inches diameter, and from this pulley motion is communicated to the driving wheel by a half-inch gut cord, thus allowing the engine to turn with facility. The single leading wheel is carried in a fork fitted with a volute spring and rubber washer, and governed by levers as shown. The boiler is fed by a No. 1 brass injector placed through the foot plate. The engines are covered from the weather, and it will be seen that there is plenty of power to ascend a considerable incline. As regards speed, it could be guaranteed to run 100 miles per day of ten hours over any high road in England, which, with a good driver, might be considerably increased. In conclusion it may be stated that it is the duty of the man on the right to drive and steer, and, if necessary, work the brake, and the one on the left to fire the boiler and look after the water.—*The Engineer.*

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Universal Screw and Brad Box.

MESSRS. EDITORS:—A desideratum in all cabinet and coach makers' shops is an arrangement of boxes or drawers in which to keep screws, finishing nails, etc.



In the accompanying drawing, you will see the plan upon which I made a screw and brad box for my own use. And regarding the efficiency of the arrangement I can say it fully meets the demand. It is of a circular form, though not necessarily so; the casing inclosing any number of rotary shelves which have a post passing through their centers, the post working in the lower and upper circular boards of the casing. The shelves are separated to the required depth of the drawers. Facings or small strips reaching from the lower to the upper shelf, being fastened to each shelf, serve to brace the shelves, and also form side rails for the drawers, of which there will be as many on a shelf as there are of facings.

The post upon which the shelves are fastened, passes through the top board of the casing far enough to fasten a pointer on it. This top casing is numbered with the length of screws, brads, etc., etc., in such a manner that when the pointer—turning which of course turns all the shelves—strikes the length of screw or brad as numbered, the screw or brad drawer is at the vertical opening, which may be closed when not in use, by a door. For screws, of which one length has different thicknesses, there may be as many drawers used, one above another, as there are thicknesses of screws, and the drawers then numbered with the thicknesses. One circular row of drawers will serve for brads; the rest may be devoted to screws.

J. B., JR.

New Franklin, O.

Girdling Fruit Trees.

MESSRS. EDITORS:—Seeing in your paper of February 19th a notice from the Boston *Journal of Chemistry* on the recovery of fruit trees after being girded, I beg to inform you that in Europe the practice is quite common, and it is very common to serve individual branches so, every gardener knowing that a branch so served will be covered with blossoms the following year.

C. H. H.

Thomaston, Conn.

The Value of a Practical Journal.

MESSRS. EDITORS:—For years I have taken the SCIENTIFIC AMERICAN by subscription and through news agents, and since you cannot be insensible to the vast good and pleasure you render your readers, it may not be amiss for me to say

that the single number of March 5th furnished me with information that I would quickly have paid $15 for, in the articles, "Tyndall on Haze and Dust," and the answer under Correspondence to "S. T. T., of Md."

Your paper seems to stimulate thought as was written by Hon G. P. Marsh in "Man and Nature." He says: "In these pages, as in all I have ever written or propose to write, it is my aim to stimulate not to satisfy curiosity, and it is no part of my object to save my readers the labor of observation or of thought." WARREN D. PARKER.

Janesville, Wis.

Ice Formations.

MESSRS. EDITORS:—Having carefully noticed several articles of late in your columns concerning "Ice Formations," I have intended each week to communicate some facts which have fallen under my own observation for several years past, but have postponed doing so for want of time.

Your issue of Feb. 19, page 129, contains a valuable collection of facts almost all of which corroborate my own observations and conclusions for years past, and convince me that these remarkable phenomena are simply the results of that one single exception in nature's laws which teaches us that all bodies *expand by heat and contract* from loss of heat, or as it is termed "*by cold.*"

It is well known that water is that exception, and is the design of an allwise provision to prevent our wells and streams from becoming a solid mass of ice, first commencing at the bottom and reaching to the surface.

This attribute of water manifests itself at about the temperature of 40° Fahrenheit, when its cubical measurement has reached its minimum in bulk, and from which point of temperature all changes up or down the thermometer causes it to expand and become more and more buoyant. If downward until the temperature of about 32° is reached, congelation commences; and wherever the strata of water reaching this temperature for the moment may be situated, whether on its way ascending towards the surface in still water, or while rolling along in streams or moving water, its congelation commences; and the expansion continues also with the loss of each degree of heat, as indicated by the thermometer, and the ice becomes more and more buoyant and strong.

This provision of nature by which expansion commences before congelation, is of itself a sufficient explanation of all the curious ice formations and protuberances from the surface of water during its congelation.

Many an hour I have sat and watched beside my glass aquarium, both in sunlight and shade, in a cold room, the formation of ice upon the surface and glass sides, from its incipiency until it had acquired two inches or more in thickness, before ice would commence forming upon the bottom, although the exposure was all the same and the iron bottom actually a better conductor to abstract the coloric from the water than the glass sides and atmosphere. Often I have seen shooting almost instantaneously from the highest points of the largest pebbles along the bottom, when the point of congelation is reached there, thin flat spires of ice, as thin as tissue paper, and about one eighth of an inch in width, and extending from one and a half to two and a half inches in a straight line, but always inclining nearly 45° with the horizon, and to the northward. These spires as soon as formed would in turn shoot from their edges, commencing at their base, flat branches of the same width and thickness, and of one half to one inch in length, and nearly at right angles, and all in the same plane with the main spire. These branches would be as near each other as seemed possible, thus forming a beautiful representation of the pointed ends of the fern leaf. In another moment the ice would form between these branches from the main stem to near their ends, thus presenting a beautifully radiated leaf-like formation with serrated edges; and in another moment this formation, apparently from its buoyancy, would become separated from the pebble, and shoot rapidly upward to the surface ice, or if at the opening made through the surface it would often protrude full half length above the surface as it came upward, then float flatly upon the water and immediately affix itself to the surrounding ice.

These formations were so rapid that several would sometimes be formed in the space of one minute, and what was occurring at this one point could often be seen in several different parts of the aquarium, which was about fifteen inches square, and twenty-four inches long, with about twelve inches of water. After the ice had reached about two inches in thickness on the sides and surface, it commenced forming on the bottom even more rapidly, and adhered to it. A gold fish about five inches long, which had been in it nearly two years, became completely surrounded, and apparently motionless. The freezing being allowed to progress until the center with the fish became one solid block of ice, and the glass sides as well as surface began to bulge from expansion, with every indication of fracturing; at this juncture the temperature of the room was raised and thawing commenced, when after about thirty-six hours the ice disappeared and the fish became as lively and healthy as before his cold bath, and lived nearly a year afterwards. I should have remarked that the thermometer indicated nearly three degrees higher temperature of the water at the bottom than at the surface during the leaf ice formations.

The last phenomena of different temperatures can always be noticed by using two thermometers in ice cold water in an ice pitcher or jar having floating ice, and with the water to the depth of eight to ten inches or more, as the bulb at the bottom will indicate from two to three degrees higher temperature than that near the surface.

With these remarks I conclude, by simply stating that the temperature of the ice in the aquarium, when solid, indicated only about six or eight degrees of cold as it is termed, or about 24° to 26° Fah. HORACE L. EMERY.

Albany, N. Y.

[With this interesting contribution from Mr. Emery we close the discussion of "Ice Formations," which seems to have elicited much attention.—EDS.

Errors in Regard to Gravitation.

MESSRS. EDITORS:—In your issue of January 29th, current volume, Mr. B. F. Wilson treats facetiously the common errors in respect to the tendency of all bodies near the earth to fall toward its surface. He should *write* with gravity in treating of gravitation. He says:

"The notion that shots rise after leaving the gun is probably older than rifles."

We differ from him. Why not add, for popular instruction, show that this notion probably had its origin in the disposition of the sights of guns? All sights are such that the eye used in firing looks along a line that crosses the axis of the gun prolonged, and reaches the object aimed at more or less below that line. Hence there are two "points blanc;" one where the axis of vision crosses the axis of the barrel of the piece, and the other at the point where the parabola, described by the ball in falling, crosses the axis of sight. Any object struck by the ball between these two points blanc, will apparently, show that the ball has risen, because the point struck will be above the axis of sight.

The impression that a ball rises after leaving the piece, has probably been produced by the common impression, that the line of sight is parallel with the axis of the gun barrel. C. G. FORSHEY, C. E.

Galveston, Texas.

Inspection of Steam Boilers.

MESSRS. EDITORS:—I was reading in your last paper about the "Inexplicable Power" at Dayton, Ohio. Now in this State (Conn.), there is a law providing for the inspection of steam boilers once a year. Well, the inspector comes around, and as the owner of the boiler don't want to stop work, he inspects the steam gages, looks at the safety valves, asks a few questions, and gives a certificate, which is locked up in the safe. He takes his money, and you see no more of him until next year, when it is gone over in the same way. I am running a set of boilers now, which I will guarantee the inspector knows no more about than you would, should I give you a description of their make. Sometimes they will try water pressure, but I have never seen a boiler thoroughly inspected since the law has been in force. And in consideration of the fact that there is not one in ten engineers (?) that has the least knowledge of the powerful element of which he has charge, is it not a wonder that there are not more wholesale murders than there are now? NIMROD.

Log Roller Wanted.

MESSRS. EDITORS:—Nothing is more needed in our heavily timbered bottom lands than some invention that will enable us to get rid of the timber on our clearings with more ease. By far the heaviest part of clearing is getting rid of the timber which falls, for three or four years after a piece of land is cleared. Thousands of acres would be cleared that now lie unimproved, if there was some good way fixed for one or two men to pile up the logs, so they can be burned.

Ox teams in Texas are cheap, and every farmer can afford a good ox team. It occurs to me that some sort of wagon might be invented, with bowed or crooked axles, without center gearing, that would enable one man, by aid of a screw to each axle, to drive over a log and swing it some four or six feet high from the ground, then, after hauling it to the pile, put under jacks or props, clear the ends by turning back the axles, lay a pair of skids from the log to the log pile, then give the log a turn with a lever to let it roll itself to its place on the log heap. Such an invention would be of vast importance here in Texas, where there is so much unimproved heavily timbered land that must some day be cleared.

Crockett, Texas. I. A. ANSLEY.

The Unit of Work and the Unit of Force.

MESSRS. EDITORS:—By the criticism on my Foot-pound paper (page 157) I am erroneously made to assume the foot-pound to be a *unit of force* instead of a *unit of work*. I quoted the term "unit of force" from authority, adding marks of quotation, and regret their omission in print. I conformed to, and treated, the quoted term to its results, and then followed by a more practical view, suggesting its agreement with the horse-power of Watt—550 pounds, 1 foot high in a second, or its equivalent, as stated by the critic, of 33,000 pounds in 1 minute. A careful reading of the manuscript would have shown the criticism unnecessary.

THOS. W. BAKEWELL.

Pittsburgh, Pa.

PROFITS OF ADVERTISING.

The benefits of advertising are appreciated by a great many of our most successful firms, but this mode of creating business is not half enough considered by the majority of persons who are complaining of dull times. Persons having machinery or patents to sell should read the following unsolicited letter:

MESSRS. MUNN & Co.:—*Gentlemen*:—The first time that I ever advertised in any paper was in your issue of Feb. 12, 1870, for the sale of my patent right for the South and West for my kerosene oil safes. I was hard to be convinced of the advantage to be received, and I am most happy to say that my expectations have been realized. I have reaped from the single insertion nearly $4,000.

Most respectfully yours, G. D. ANDERSON.

Peekskill, N. Y., March 14, 1870.

RECENT SPECULATIONS ON THE EARTH'S ORIGIN.

[From the Evening Post.]

The *Edinburgh Review* for January has an interesting article upon "Geological Theory in Britain," which sums up the results of recent inquiry and speculation among scientific men in this great field. Nothing shows better the great change which has taken place in the tendencies of scientific study of late years than the new geological theories now discussed. A generation ago, it was the accepted practice of each branch of science to pursue its own course in isolation; to devote its strength to filling up its own outline, rather than to connecting that outline with other branches; and so, by an ever minuter division of labor, to cut itself off more and more from the current of thought among intelligent men in general, and to fall into the hands of trained but often narrow specialists. Now all this is changed, and the natural sciences are linking themselves together more closely every day. Astronomy, geology, natural history, mineralogy, physical optics, chemistry, and electricity approach the solution of the same questions hand in hand; and the most influential theorists in each of these branches are men whose researches extend, more or less, into them all.

The reviewer divides all theories as to the course of geological changes into three classes—those which assume forces formerly at work, entirely distinct in kind, or at least in degree, from any now known; those which assume that the forces of nature are strictly uniform, and that the past changes in the earth have been produced by causes now at work; and those which assume a definite progress towards some goal. Catastrophism is, according to Professor Huxley, the doctrine of a past era in geological inquiry; uniformitarianism, that of the present; while to the third, or evolutionism, he assigns the high honor of being that of the future. The evolutionists of the present day are few in number, but eminent in reputation. Dr. Tyndall, Mr. Herbert Spencer, Professor Huxley, and Sir William Thompson may be quoted as the most prominent leaders in England. The doctrine of the origin of species is indeed merely evolutionism applied to biology, and so far Mr. Charles Darwin may also be considered to belong to this school. Its founder was the great Emanuel Kant, whose work in physical science is only now beginning to be duly recognised.

The notion of sudden "catastrophes" at remote periods, by which mountain chains were upheaved or seas opened, is now generally abandoned. Sir Charles Lyell has succeeded in making the doctrine generally accepted that geological facts are to be explained by forces now at work; that the same power which now raises the coast of Scandinavia at the rate of a few inches in a century, and depresses that of parts of New Jersey about as fast, if it has time enough to work in, will suffice to make continents of all the oceans and to submerge every continent; that the earthquakes and eruptions which have built up some mountains and islands in our own time need nothing but more time to build innumerable others But, according to the most enterprising speculators in this field, the last word on the earth's history is not to be spoken by geology alone; and the changes which are recorded in the rocks under our observation are not the limits of our inquiries.

Indeed, the other sciences sometimes attempt to contradict the conclusions of geology. Mr. Darwin thinks that the washing away of the rocks from the ruins of which the famous "Wealden" strata in the southeastern part of England were formed could not have taken place in less than three hundred million years; and others have thought it more reasonable to assume ten times that period as necessary. But Sir William Thompson insists that this is contrary to known principles of physical science. He says that the sun and moon, acting on the tide wave of the ocean, slowly retard the motion of the earth on its axis; so that it must have been revolving so fast one hundred millions of years ago that no life could exist on its surface, while even the lowest of the Wealden strata are full of fossils. He says the sun is losing its heat by radiation so fast that, at the present rate of emission, it could not have illuminated the earth so long as the geologists claim; while the earth itself must have been one molten mass at anything like the remote period to which they refer these rocks.

But all these arguments are indefinite and unsatisfactory. That which seems most susceptible of one day furnishing a precise argument is the tidal retardation of the earth; but mathematicians are by no means agreed as to its degree, or even its nature; and the reviewer seems to us to attach entirely too much weight to it. It is not certain that it exists to anything like the extent claimed by Sir William Thompson; if it does, it is not certain how long it has existed to this extent; for the form, size, and continuity of the ocean, the distance of the moon and some other elements of the problem may have varied. But, however this may be, Mr. Huxley shows that one hundred millions of years afford probably room enough for all known geological facts. Doubtless a far longer period is probable: and no astronomical or physical presumption has yet been raised against it.

The new geology, then, inherits from the old school the right to assume all the time it needs; it accepts from the "uniformitarians" their rigid adherence to the doctrine of the permanence of law, and claims no force not to be found now at work in nature; but it extends its inductions into new fields of thought and discovery. It finds the system of worlds now existing in space consisting of the following, among other, forms of matter:

First—There is the sun, clearly proved to be a "great fiery globe surrounded by an atmosphere of intensely heated gases and vapors, that are continually rising or falling, like our clouds, according to their change of temperature." Flames

of burning hydrogen flare out seventy or ninety thousand miles beyond the dazzling atmosphere of light. This "photosphere" itself has already been proved, by spectrum analysis, to contain certainly thirteen elements familiar to us on the earth, besides some that are doubtful. In other words, the sun is made of the same materials as the earth, but on fire.

Second—The stars, so far as they can be examined, yield similar results. Nine of our elements have been detected in Aldebaran, including three metals not yet observed in the sun. The nebulæ are made up, some of remote solid stars, but some chiefly of such well-known gases as hydrogen and nitrogen. In short, the starry heavens are made up of matter similar to that of the earth.

Third—The planets generally resemble the earth in form, in solidity, in atmosphere, in their general relation to the sun and his system. Most of them are veiled, some of them very thickly, with clouds; but when their faces can be seen, they show still more striking resemblances to the earth. Mars, for instance, is whitened in every one of his long winters, over all the polar regions, by heavy falls of snow, which melts away again in summer.

Fourth—Meteorites frequently fall to the earth out of space. They are but small planets, turned out of their course by its attraction; and they bring to it nothing new. Twenty-seven of the elements have been found in these wandering bodies; combined just as they often are in our own rocks; and supposed, with the strongest reason, to be specimens of what the earth contains in its hidden depths.

Other facts might be quoted, in addition to those furnished by the reviewer, and bearing on the same conclusion. He might have pointed to the recent researches of Professor Tyndall into cometary matter; to the spectroscopic revelations concerning the identity of the Zodiacal Light with the sun's "corona"; and to recent speculations upon the auroral streamers. But these are enough to justify his inference:

The inevitable conclusion derived from the study of the heavenly bodies—of sun, earth stars, meteorites, and nebulæ—is that the immeasurable space is full of matter of the same kind, but aggregated in different fashions: sometimes being gaseous, at other times solid, sometimes in a state of the most intense heat, at other times cooled sufficiently to admit of the presence of life, as in the Earth and Mars, or lastly, cold, barren, and lifeless, as in the meteorites. Whether the gaseous condition of matter preceded in any particular case the solid we cannot tell. So far as our earth is concerned, the only idea that we can grasp of its origin is that it was a fiery body like the sun, and that it has been gradually cooling from that time down to the present day. This realization of the steady change is a fundamental doctrine of evolutionism.

In short, the earth was once a molten ball, a source of light, like the sun. It has cooled off, and is cooling still. The sun too is cooling; its vast size makes the process slower; but the result is inevitable, and it will one day be what the earth is now. On the other hand, the earth, too, has its destiny: "the time will arrive when, like a meteorite, it will become cold to its very core, and when life will cease to be found upon it, on account of the low temperature." The process may be delayed by collisions with other bodies; for the immense force with which they move is turned into heat by impact, and the stoppage of the motion of the earth itself, by falling into the sun, would furnish as much heat as is radiated from the sun in ninety-five years. "It is absolutely certain that all planetary matter is inevitably gravitating toward the sun, which will be the common bourne of our system. 'As surely,' eloquently writes Sir William Thompson, 'as the weights of a clock run down to their lowest position, from which they can never rise again, unless fresh energy is communicated to them from some source not yet exhausted, so surely must planet after planet creep in, age by age, toward the sun; not one can escape it fiery end. In like manner the satellites of the planets must inevitably fall into their respective planets.'"

The reviewer refuses to look beyond this melancholy conclusion, and will not regard this history "as a never-ending cycle of change, or as a kind of phœnix life." To him, the aggregation and final chilling of the entire system into one blind, black, lifeless mass is simply the end. But, admitting all to be true which he shows to be probable, what becomes of the heat thus lost? Whither is to go the force that now animates and revives the universe around us? Assuredly the task of such speculations is not ended, until that force is traced into new relations, which, since no reason is shown for the contrary, may be pictured as more varied and glorious than any in the present.

After the close of what he terms the evolution of the system, and after its final catastrophe, the boundless space will still contain all of matter and all of force that are in it now; and if these have sufficed for the organization of our present cosmos, they may suffice for another. There is nothing in the argument before us to show that this is an exception to the starry universe at large; that life is limited to one or a few of the heavenly bodies, or even that mind, in some of its conscious forms, is confined to one stage in the great cycle of their evolution. Rather, the strong analogy shown to exist between the earth and all her sister spheres, suggests that the entire creation may be one, not only in its substance and in the laws which control its masses, but also in the constant and universal production of beings capable of enjoying its bounties and delighting in the intelligence it expresses. There is nothing to show that the particular astronomical epoch in which we live is an exception to the general history of the universe, or that this earth and those who inhabit it are the highest achievement of the formative skill which built the whole.

It is still open to the dreamer to amuse his leisure, or to the believer to comfort his faith by peopling myriads of worlds with nobler beings than ourselves; and to even imagine that the inevitable wreck of our little earth and narrow sky will be watched by them from without, as one scene of a larger drama in which many such tragedies are included, but whose end is good.

Hardening Saws and Springs.

Saws and springs are generally hardened in various compositions of oil, suet, wax, and other ingredients, which, however, lose their hardening property after a few weeks' constant use: the saws are heated in long furnaces,and then immersed horizontally and edgewise in a long trough containing the composition; two troughs are commonly used, the one until it gets too warm, then the other for a period, and so on alternately. Part of the composition is wiped off the saws with a piece of leather, when they are removed from the trough, and they are heated, one by one, over a clear coke fire, until the grease inflames; this is called "blazing off."

The composition used by an experienced saw maker is two pounds of suet and a quarter of a pound of beeswax to every gallon of whale oil; these are boiled together, and will serve for thin works and most kinds of steel. The addition of black resin, to the extent of about one pound to the gallon, makes it serve for thicker pieces and for those it refused to harden before; but the resin should be added with judgment, or the works will become too hard and brittle. The composition is useless when it has been constantly employed for about a month; the period depends, however, on the extent to which it is used, and the trough should be thoroughly cleansed out before new mixture is placed in it.

The following recipe is recommended:

Twenty gallons of spermaceti oil; Twenty pounds of beef suet, rendered; One gallon of neat'sfoot oil; One pound of pitch; Three pounds of black resin.

These last two articles must be previously melted together, and then added to the other ingredients; when the whole must be heated in a proper iron vessel, with a close cover fitted to it, until the moisture is entirely evaporated, and the composition will take fire on a flaming body being presented to its surface,but which must be instantly extinguished again by putting on the cover of the vessel.

When the saws are wanted to be rather hard, but little of the grease is burned off; when milder, a larger portion; and for a spring temper, the whole is allowed to burn away.

When the work is thick, or irregularly thick and thin, as in some springs, a second and third dose is burned off, to insure equality of temper at all parts alike.

Gun-lock springs are sometimes literally fried in oil for a considerable time over a fire in an iron tray; the thick parts are then sure to be sufficiently reduced, and the thin parts do not become the more softened from the continuance of the blazing heat.

Springs and saws appear to lose their elasticity, after hardening and tempering, from the reduction and friction they undergo in grinding and polishing. Toward the conclusion of the manufacture, the elasticity of the saw is restored, principally by hammering, and partly by heating it over a clear coke fire to a straw color; the tint is removed by very diluted muriatic acid, after which the saws are well washed in plain water and dried.

Watch springs are hammered out of round steel wire, of suitable diameter, until they fill the gage for width, which, at the same time, insures equality of thickness; the holes are punched in their extremities, and they are trimmed on the edge with a smooth file; the springs are then tied up with binding wire, in a loose, open coil, and heated over a charcoal fire upon a perforated revolving plate, they are hardened in oil, and blazed off.

The spring is now distended in a long metal frame, similar to that used for a saw blade, and ground and polished with emery and oil, between lead blocks; by this time its elasticity appears quite lost, and it may be bent in any direction; its elasticity is, however, entirely restored by a subsequent hammering on a very bright anvil, which "puts the nature into the spring."

The coloring is done over a flat plate of iron, or hood, under which a little spirit lamp is kept burning; the spring is continually drawn backward and forward, about two or three inches at a time, until it assumes the orange or deep blue tint throughout, according to the taste of the purchaser; by many, the coloring is considered to be a matter of ornament, and not essential. The last process is to coil the spring into the spiral form, that it may enter the barrel in which it is to be contained; this is done by a tool with a small axis and winch handle, and does not require heat.

The balance springs of marine chronometers, which are in the form of a screw, are wound into the square thread of a screw of the appropriate diameter and coarseness; the two ends of the spring are retained by side screws, and the whole is carefully enveloped in platinum foil, and tightly bound with wire. The mass is next heated in a piece of gun barrel, closed at the one end, and plunged into oil, which hardens the spring almost without discoloring it, owing to the exclusion of the air by the close platinum covering,which is now removed,and the spring is let down to the blue before removal from the screwed block.

The balance or hair springs of common watches are frequently left soft; those of the best watches are hardened in the coil, upon a plain cylinder, and are then curled into the spiral form between the edge of a blunt knife and the thumb, the same as in curling up a narrow ribbon of paper, or the filaments of an ostrich feather.—*Byrne's Practical Metal Workers' Assistant.*

THERE are in the United States forty-eight manufacturers of railway cars. Seventeen of these are in Pennsylvania.

How to Build a Stable.

Generally speaking, we consider bricks the very best material with which to build stables; even preferable to stone, from the fact that the walls inside, having a smoother face, may be kept cleaner, freer from cobwebs and dust deposits than stone walls; and, if built with hollow walls, more free from dampness also; though this is a matter of not so much consequence, as in this climate there will not dampness enough penetrate a solid wall to cause any injury to the horses. It is very desirable, however, to have a stable rat-proof; and it may be made thoroughly so by commencing with a stone foundation—the bottom course of which is broader than the stone-work above it—laid in half cement mortar up to the grade line, and then building the brick wall upon that, filling in all the space inclosed by the walls with concrete up to the line of the top of the water table, and then paving it with large stones firmly bedded, which shall form the floor of the stable. On the outside there should be a stone water-table eight or ten inches high, projecting one or two inches outside of the main walls above, and having the upper surface of the projection beveled off to shed the water; and just above the water-table it would be well to have a course of slate built in the full thickness of the walls, which will prevent any dampness rising up into them from the ground by capillary attraction.

Above the water-table the walls should be built up with a *smooth face*, and with *close, neatly struck joints inside as well as out*, so as to present a clean, even surface, which should always be kept painted or washed with a lime or cement wash. Above the wall-plate the space should be filled in to the under side of the roof-boards.

The ceilings over the main story are usually left with the second story floor beams exposed to view, but we think it very desirable that they should be lathed and plastered; partially, for the sake of the wholesome, cleanly appearance a white ceiling always has, and for the sake of keeping away cobwebs, which, when beams are exposed, always get lodgment—and partially to prevent foul air rising from the room below and tainting the hay in the loft. We would also trim the doors and windows inside with architraves, even if they are only narrow strips of the cheapest stuff.

These two last hints, by the way, are just as valuable for a wood as for a brick stable.

It may be desirable, in some instances, to *fur out* and lath and plaster the walls of a stable, but if this is to be done, it is better to wainscot with wood up to the hight of, say five feet, and to fill in the space between the walls and the wainscot, as high as practicable, with broken glass and mortar, and then to lath and plaster from the wainscot up to the ceiling. A wooden stable, too, may with advantage be treated in the same way, but the space behind the wainscot being wider, may be packed with bricks and mortar, and made solid in that way.

We know it is not customary to put any finish of any kind upon the interior of stables, but we also know that in nine cases out of ten, in ordinary stables, and very frequently in those of a better class, the interiors are perfectly filthy with dust which lodges on every ledge, and overhung with cobwebs which hang thick and heavy from and between the beams overhead, besides being completely *set out* with such objects of "*vertu*" as old sponges, curry-combs, and brushes; bottles of castor oil, dusters, and a dozen other things of the same sort, which are thrown after use upon any projecting beam or ledge that may happen accidentally to be wide enough to hold them.

Now, certainly this sort of thing is not agreeable to the eye, and any person who has fine horses, and takes a proper pride in them, should not overlook it; yet, the groom, if questioned, will say, and truly, too, that he might be brushing all the time and he couldn't keep dust and cobwebs away, so long as there are places for the latter to hang and the former to lodge; in fact, there is only one way, and that is to follow the plan of finishing off that we have suggested, covering up all such places, moreover, making everything so convenient for the most trifling operations of stable economy that there can be no inducement, or excuse even, for carelessness or neglect of any kind.—*Harney's Stables, Outbuildings, and Fences.*

To Brown Gun Barrels.

Take of nitric acid, half an ounce; sweet spirits of niter, half an ounce; blue vitriol, two ounces; tincture of steel, one ounce. Mix all together in eight gills of water. Apply this mixture with a sponge, then heat the barrel a little, and move the oxide with a hard brush. This operation may be repeated a third and fourth time, till you have the brown required.

It is then to be carefully wiped, and sponged with boiling water, in which there has been put a small quantity of potash. The barrel being taken from the water, must be made perfectly dry, and then rubbed smooth with a burnisher of hard wood; afterward heated to the hight of boiling water and varnished with the following varnish: Take of spirits of wine two parts, dragon's blood, powdered, three drachms; shellac bruised, one ounce; dissolve altogether. This varnish being laid on the barrel, and become perfectly dry, must be rubbed with a burnisher to render it smooth and glossy.—*Brass and Iron Founder's Guide.*

IT is said that preserved fruit and vegetables may be made to retain their green color by digesting them for some time in boiling salt water. After removing the latter, vinegar should be poured over them while boiling hot, removed on the third day, boiled, and poured on again. The repetition of this process a few times produces a dark green color, not dangerous, like the ordinary verdigris.

Improved Mode of Rigging Gaff Topsails.

Whatever tends to increase the safety of vessels and the lives of seamen, and to add to the facility and rapidity of working ships, is of great importance, both in a commercial and humanitarian point of view. Our engraving presents such an improvement. Its importance is such as in our opinion ought to secure universal attention.

We are fully assured that all that is claimed for it has been fully sustained in actual service in all kinds of weather, and that an examination will commend its merits to all intelligent seamen.

The gaff is provided with a shaft lying longitudinally above and parallel to the gaff, rolling in suitable bearings, when actuated by a rolling line which runs over a grooved pulley at the end nearest the main-mast. The sail, instead of being parallel in the usual manner, is wound upon this shaft by men stationed at the rolling line *on deck*.

The sail is hoisted by the gaff-topsail halyard, but the attachment of this halyard to the sail constitutes one of the leading features of the improvement.

To the apex of the topsail is attached a metallic head, as shown in the engraving. This head is formed so that the portion next the mast is cylindrical. The portion extending from this cylinder is wing-shaped, and performs an important function, which will be described hereafter.

The cylindrical portion is hollow, and is provided with a spring latch, which holds a catch formed in a cylindrical piece of metal attached to the end of the gaff-topsail halyard. On the side of the topmast is fixed a guide groove made of iron. This may be described as a pipe with a slot in the aft side of its entire length; and of such a width as to admit the wing of the head affixed to the apex of the sail above described, while the cylindrical portion of the head runs in the interior.

The inner edge of the sail is bound with leather which protects it from wear against the edges of the slot in the guide groove.

When the gaff-topsail halyard is hauled in, the sail is unwound from the shaft; and, as the halyard passes through, the sail-head enters the bottom of the guide-groove, which is made slightly recurved and trumpet-mouthed to facilitate its entrance. The gaff is sustained by a wire rope attached to its point and running back to the peak-halyard blocks. When in tacking it is desired to shift the sail from one side to the other, a messenger provided with a counterpart to the cylindrical portion of the sail-head is attached to the gaff-topsail halyard, by a man who ascends to the jaws of the gaff for that purpose. This messenger runs in a block at the peak of the mainmast, and carries the end of the halyard over from one side to the other, when it can instantly be again attached to the sail, which can then be hoisted as before.

It is claimed that in this form of rigging the following important advantages are secured:

The sail can be set and furled without the necessity of a man leaving the deck. It may be reefed or set over reefed canvas.

It may be set flatter and stand longer by the wind than in the old method; the gaff being securely held to the topmast, and the foot to the shaft along the gaff.

It may be set quicker and taken in quicker, two minutes being the maximum time required to take it in, in any weather. The sail may also be taken in without any danger of losing it.

The sail may be rolled snugly while tacking, or jibing the ship, and set quicker when about. It may be handled with greater ease by less help.

It will wear much longer, being free from chafe and shake.

Instead of being tied up in a wad alongside of the mast head exposed to weather, when the lower canvas comes down, it, too, comes down, and is covered with the same sail coats.

It leaves the spars aloft free, and gives a more graceful and light appearance to the rigging.

It lessens the danger attending the smothering of a sail and stowing it in the old way, which sometimes results in loss of life.

The halyards being so arranged that the throat and peak are hoisted on a runner, the lower canvas is easier made than in the old way.

The gaff-topsail when taken aback passes down with the wind under the stays, and is rolled down as readily as when on its own tack. When struck with a squall, letting go the halyards runs the sail down to leeward of the lower canvas where it lies becalmed, and from whence it can be snugly rolled up.

This method of rigging does away with sheets, tack, and clewlines, therefore making a saving of rope.

In setting sail running off the wind, the luff being held abaft the topmast, the sail hoists without furling under the topmast rigging or crosstrees.

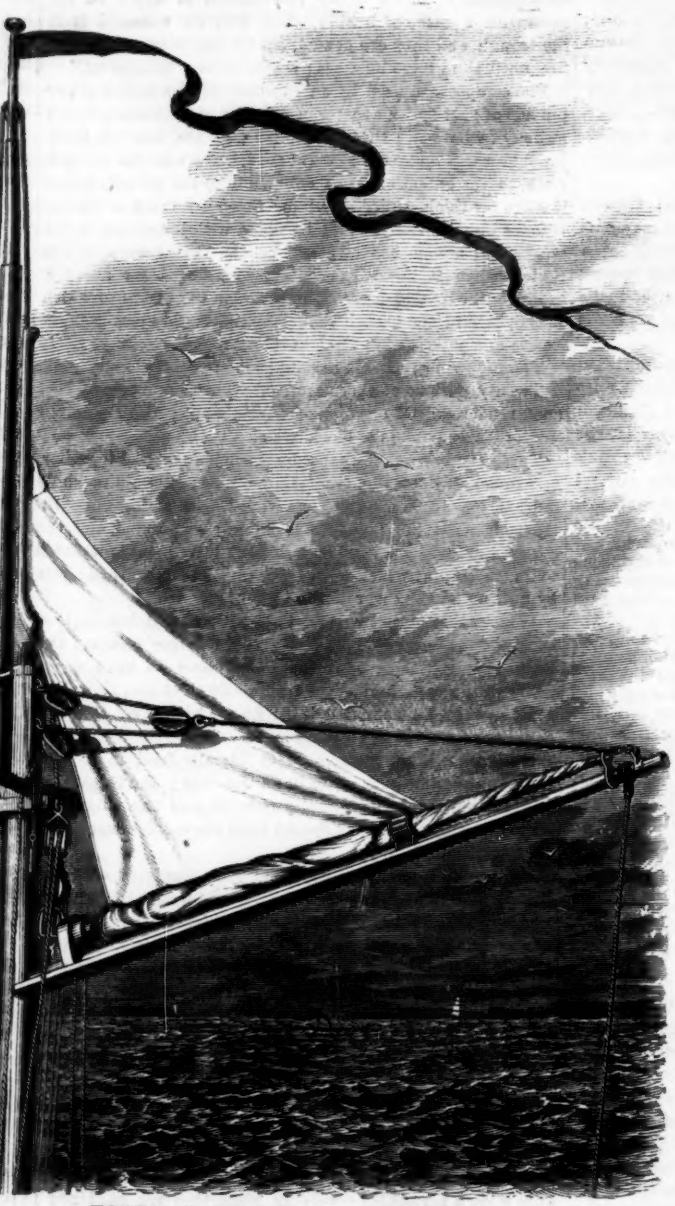
It gives the use of the sail many times when in the old method it would have to be in and stowed.

In short, it is claimed that this invention is time saving labor saving, and material saving; and, as it obviates the danger to which men are sometimes exposed when aloft, that it is life saving also.

As it gives greater facility in handling the vessel, it is claimed that, in cases of emergency, it gives greater safety to vessels.

These claims are as important as they are numerous, and as the invention is that of a practical seaman, long accustomed to the old method and understanding fully its defects, it has been constructed with a view to remove all those defects, and to supply a perfect and practical gaff-topsail rigging.

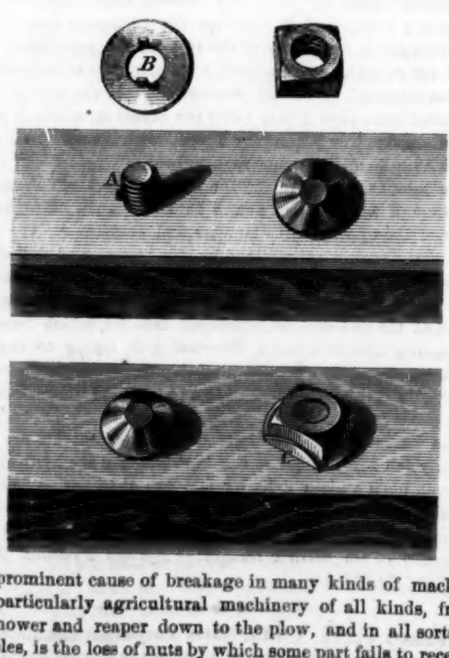
Patented, through the Scientific American Patent Agency, June 29, 1869, by Capt. Geo. A. Ford, Oswego, N. Y. For further information address him as above.



FORD'S GAFF-TOPSAIL RIGGING.

WILLIAMS' IMPROVEMENT IN LOCKING NUTS.

Foremost among the various things to which a useful application of locking nuts is made, it is common to speak of fish joints for railways, but this—though most important—is by no means the only important use to which such nuts can be advantageously put.



A prominent cause of breakage in many kinds of machinery, particularly agricultural machinery of all kinds, from the mower and reaper down to the plow, and in all sorts of vehicles, is the loss of nuts by which some part fails to receive its accustomed support.

A large number of devices have been wrought out by ingenious inventors, designed to lock nuts securely. These devices may be classed as being, first, those which depend upon some modification of the nut; second, those relying upon some modification of the washer; third, those which employ a modification of both nut and washer; and, fourth, those which rely upon some appliance independent of the nut or washer. There are also intermediate grades of devices, employing various combinations of the principles specified.

The device which we herewith illustrate is a very simple and effective method of locking nuts, depending solely for its effect upon a modification of the washer, and the bolt-hole.

The engraving shows the nature of the improvement. The hole, as shown at A, is recessed on opposite sides. This can be done in punching, or if the hole be drilled it may be done with the file. In punching the washer, two projections are made in opposite sides of the hole and turned down as shown at B, so that when placed over the threaded end of the bolt, these projections fit into the recesses of the hole above described. The nut is then screwed on, and when turned down tight, it is locked by simply turning up the edge of the washer, as shown at C.

The recesses in the bolt hole are only employed when it is desired to lock the nuts on a metal surface. On a wood surface the projections are driven down into the wood, which, when the edge of the washer is turned up as above described, effectually locks the nut.

We regard this as a valuable improvement, and one likely to come into extended use. The washers can be made at the same cost as the old style of washers, and it would seem that they could hardly fail of coming into general request.

For further particulars address W. H. Williams, Canton, Ohio.

A New Insect Poison.

M. Cloez, who is engaged at the garden of the Paris Museum, has invented, according to *Scientific Opinion*, what he considers a complete annihilator for plant lice and other small insects. This discovery is given in the *Revue Horticole*, with the indorsement of its distinguished editor, E. M. Carrière. To reduce M. Cloez's preparation to our measures, it will be sufficiently accurate to say, take 3½ oz. of quassia chips, and 5 drachms of stavesacre seeds, powdered. These are to be put in 7 pints of water, and boiled until reduced to 5 pints. When the liquid is cooled, strain it, and use with a watering-pot or syringe, as may be most convenient.

We are assured that this preparation has been most efficacious in France, and it will be worth while for our gardeners to experiment with it. Quassia has long been used as an insect destroyer. The stavesacre seeds are the seeds of a species of lark-spur, or Delphinium, and used to be kept in the old drug stores. Years ago they were much used for an insect that found its home in the human head, but as that has fortunately gone out of fashion, it may be that the seeds are less obtainable than formerly. The stavesacre seeds contain Delphine, which is one of the most active poisons known and we have no doubt that a very small share of it would prove fatal to insects.

The Oldest Piano in America.

The oldest piano in this country, so it is supposed, has recently been presented to the New Haven Historical Society, by Mr. C. M. Loomis, the publisher of *Loomis' Musical Journal*, New Haven, Conn. This instrument was made by an Italian firm in the city of London, in the year 1786. The mechanical action is similar to pianos of the present day. The wires are small and placed together. There is a peculiar sweetness of tone to many of the chords, which would indicate that the instrument was a good one in its day. It seems that an English lady named Mrs. Sarah Palmer imported the piano to this country about 1796. Soon after it came into the possession of a family by the name of Bakewell, where it remained for a period of about sixty years. Finally Mr. Loomis obtained some knowledge of the facts narrated above, and tracked out the instrument, which he purchased for a high price, simply as a curiosity.

WHITE RUBBER SHIELDS NOT THE CAUSE OF SORE MOUTH.—An item having appeared in our paper regarding the use of rubber shields for nursing bottles, and stating that we were in receipt of a letter from a correspondent, charging that they were a cause of sore mouth in children, and also that such statements had found their way into the English journals, it is perhaps only just that both sides should be heard. We are now in receipt of a letter from the Davidson Rubber Company, stating that there is no foundation for this statement, and sustaining their denial by a certificate of S. Dana Hayes, State Assayer of Massachusetts, to the effect that he has examined the white rubber shields made by the Davidson Rubber Company, and is satisfied that they are perfectly harmless. Mr. Hayes adds that the shields do not contain lead in any form, and it is impossible to extract any injurious substances from them by saliva.

Scientific American,

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN. S. H. WALES. A. E. BEACH.

☞ "The American News Company," Agents, 121 Nassau street, New York.
☞ "The New York News Company," 8 Spruce street.
☞ Messrs. Sampson, Low, Son & Marston, Crown Building 188 Fleet st., Trubner & Co., 60 Paternoster Row, and Gordon & Gotch, 121 Holborn Hill, London, are the Agents to receive European subscriptions. Orders sent to them will be promptly attended to.
☞ A. Asher & Co., 20 Unter den Linden, Berlin, are Agents for the German States.

VOL. XXII., No. 13 . . [NEW SERIES.] . . *Twenty-fifth Year.*

NEW YORK, SATURDAY, MARCH 26, 1870.

Contents:

(Illustrated articles are marked with an asterisk.)

OUR NEW PAPER CURRENCY.

In July, 1866, letters patent were issued, through the Scientific American Patent Agency, to Jas. M. Willcox, bank note-paper manufacturer near Philadelphia, for an improvement in paper, to prevent counterfeiting. As this peculiar paper has been adopted by the Treasury Department for United States securities, and reaches the hand of everybody in the shape of greenbacks, a few words in explanation will be useful to all handlers of money.

Protection in paper, as in engraving, consists in *peculiarity* and in difficulty of imitation; nothing else. Many years ago bank-note paper was made peculiar by the mixing of red, blue, and other colored silk shreds in the pulp before converting it into sheets of paper. This peculiarity was considered a test of genuineness, and was so to a certain extent. Paper made in that way, however, came into the open market, and could be bought by counterfeiters as well as by bank officers and engravers. Mr. Willcox has added a new feature in the introduction of colored shreds, which makes a paper so peculiar that it cannot be made by hand process, or by cylinder machine, but only by the better class or Fourdrinier machine. Even here special machinery is required to *locate* the colored shreds in certain parts of the notes and not in others.

As this machinery exists only in his own mill, and the process is protected by patent, the paper is kept out of the market, and the Government and the public have the advantage of its exclusiveness. The mill is guarded night and day by an armed force in the pay of the Government, to prevent robbery, and there is every reason to believe that this paper will be kept out of unlawful hands.

It will be observed that a line of blue shreds cross the *left-hand* end of all legal tender notes (new issue) of the denominations of one, two, five, and ten dollars; and a similar line crosses the *right-hand* end of all notes above ten dollars. As these lines are in-grain, and cannot be altered, the alteration of a low note to a high one would be at once detected by the position of the localized shreds. As these shreds are interwoven with the fibers of the paper, care should be used to make sure that they are neither entirely *under the surface* nor entirely *on the surface*, but *both*.

In the U. S. currency a double process is carried out. In the first place a red fiber is mixed indiscriminately through the pulp, and consequently through the sheet. This is done in the grinding engine.

A second process (with special machinery) is carried out in the Fourdrinier paper machine by the localizing of a *blue* fiber as the pulp is changed into paper. All is interwoven together, and when the sheets are cut into notes the blue fibers find their position as described.

The new fifty cent note which the Department is preparing to issue, will be upon paper of this description; the localized blue fibers occupying one end only of the notes, while all the remainder will have the indiscriminate red. The double process of manufacture will be shown and the exclusive feature will be prominent.

The thanks of the community are due to the Secretary of the Treasury for his earnest and well-directed efforts to protect them from counterfeits; and their attention is called to a proper understanding of this new feature in protection.

As it has been placed under the guardianship of the Department, it is believed to be effectual, and we are glad to have had an agency in bringing it into use.

ISINGLASS GLUE.—Dissolve isinglass in water and strain through coarse linen, and then add a little spirits of wine. Evaporate it to such a consistency that when cold it will be dry and hard. This will hold stronger than common glue, and is much preferred.

SUPPLEMENTARY REPORT OF THE MASSACHUSETTS RAILROAD COMMISSIONERS ON STEEL RAILS.

A report supplementary to the annual report of the Massachusetts Railroad Commissioners, upon the subject of steel rails, has been presented to the legislature of that State. The information embodied in the report was obtained in answer to questions, printed in circular form, and sent to the officers of the several railroads throughout the country. The circular embraced twenty-one queries relative to the time steel rails were first employed on the respective roads, the extent to which they have been used, their weight per yard, the conditions under which they have been used, their relative cost as compared to iron, and the general results of experience in their use.

Replies to these inquiries were received from 57 roads, twenty of which have made no trial of steel rails; others have tried only a few by way of experiment, and find them, so far, greatly superior in durability to iron rails in similar situations. Twenty-six roads have laid steel rails in amounts varying from 100 tuns to 15,000 tuns and their reports are generally very much in favor of steel rails, particularly, for heavy service.

The names of the roads and the amounts of steel rails they have laid are respectively as follows:

Eastern Railroad, Mass., 410 tuns, about four miles. Weight of rail 56 and 60 lbs. to the yard. Boston and Maine Railroad, Mass., 100 tuns; 60 lbs. to the yard. Boston and Albany, Mass., 1200 tuns, 57 to 62 lbs. to the yard. Boston and Providence, Mass., 1400 tuns, 52 to 62½ lbs. Old Colony and Newport, Mass., 135 tuns, 55 and 60 lbs. to the yard. Vermont Central, 100 tuns, 60 lbs. Connecticut River Railroad, 405 tuns, 56 to 60 lbs. New York and New Haven, 5,500 tuns, 62 lbs. to the yard. Erie Railway, 8,509 tuns, 56 to 62½ lbs. Camden and Amboy, N. J., 1,500 tuns, 56 lbs. North Pennsylvania, 400 tuns, weight of the rails per yard not given. Philadelphia, Germantown, and Norristown, Pa., 350 tuns, 60 lbs. to the yard. Northern Central, of Pa., 300 tuns, 60 lbs. Lehigh and Susquehanna, Pa., 5,100 tuns, 60 lbs. to the yard. Philadelphia and Reading, Pa., 800 tuns, 60 to 64 lbs. Philadelphia, Wilmington, and Baltimore, 3,110 tuns, a small portion 51, but the rest 56 to 58 lbs. Pennsylvania Railroad, 14,794 tuns, 56 to 67 lbs. to the yard. Pittsburgh, Fort Wayne, and Chicago, Ohio, 400 tuns, 60 lbs. Toledo, Wabash, and Western, Ohio, five miles, 60 lbs. to the yard. Cincinnati, Hamilton, and Dayton, Ohio, 400 tuns, 60 lbs. Michigan Central, 298 tuns, 61 lbs. Michigan Southern, two miles, 57 to 62 lbs. to the yard. Chicago and Northwestern, Ill., 1000 tuns, 60 lbs. Chicago, Burlington, and Quincy, Ill., 300 tuns, 60 lbs. Chicago, Rock Island, and Pacific, Ill., 1,600 tuns, 56 and 57 lbs. per yard. Chicago and Alton, 800 tuns, 54 and 60 lbs.

The aggregate of these amounts, added to amounts not communicated by other roads, but ascertained from the report of the State Engineer of New York, and other sources, form the basis of the estimate, that at least 100,000 tuns of steel rails were laid in this country on the first of January, 1870. The conclusions derived from the experience of various railway companies, and given in full in the report may be summed up as follows:

Extremes of temperature do not injuriously affect steel rails. In one case (the Grand Trunk Railway), they have been subjected to a temperature of 30° Fah., without injury. The durability of steel rails far exceeds that of the best iron rails. Two roads, the Erie Railway and the Providence road, report steel rails as having outworn thirteen sets of iron ones; the Chicago and Northwestern, fifteen sets; and the Philadelphia, Wilmington, and Baltimore, *seventeen sets*.

It is also found that heavy grades and sharp curves do not materially affect the wear of the rails. Also, that if the rails be carefully inspected before laying, all flaws and imperfections can usually then be discovered, and that risk to life and property from the breaking of rails may be almost wholly obviated by proper tests, and a small additional expenditure. It seems to be agreed that square notches punched in the base of the rail almost always originate seams or fractures. Some advocate punching the stem of the rail, but the majority favor drilling instead of punching.

The report states that the manufacture of steel-headed rails has made such advances that they are now very serviceable and satisfactory in use, and that their employment is extending, and likely to continue to extend.

It is shown that interest on the investment is a controlling element in the question of the relative economy of iron and steel rails, and the Commissioners seem to incline to Sandberg's estimate, made on the basis of interest at five per cent, which is, that "where ordinary iron rails are worn out in five years or less, solid steel rails are most economical; where they last over ten and up to fifteen years, steel-headed rails would be the cheapest; but if the iron rails will last from fifteen to twenty years, or more, it is cheapest to use them."

The report concludes by stating, that a form of compound rail of two sides ⌋ ⌊ of iron, with a ⊤ of steel resting upon them, and all three parts bolted together, has been recommended by several parties, and, in the opinion of the Commission, is likely to prove very satisfactory.

PROPORTION OF HEAT UTILIZED IN STEAM ENGINES.

How the proportion of heat utilized in steam engines from the combustion of coal or other fuel is determined, has been a subject of inquiry from some of our correspondents. We shall in the present article endeavor to make this subject as clear as may be, premising, however, that to those not familiar with the elementary laws of heat the subject presents some difficulties. It will therefore first be necessary to refer to some elementary principles.

It has been found that the rise and fall of the thermometer is not an index of the heat contained in different bodies, and that this instrument can only indicate what is called "temperature," a term very distinct from heat. Temperature is a generic name for certain manifestations of heat, which bear no constant relation in different bodies to the absolute amount of heat present. A better term than temperature is *sensible heat*. It is this heat which is indicated by the thermometer. The heat which exists in substances, and which does not act to expand other colder bodies when near to those substances, and which does not produce the sense of warmth in the animal economy, is called latent heat.

In other words, all substances have definite capacities for heat, and may possess a certain amount without that heat being directly perceivable, and it is by making this latent heat appear as sensible heat by transferring it to other bodies with less capacity for heat, or by reducing the capacity of bodies for heat that its existence is determined.

This may be done by chemical action. Put quicklime and water together, and, although both bodies may possess a very low temperature, their latent heat, being converted into sensible heat by the reaction which takes place, will develop a high temperature in the mass.

When air or any other substance is compressed by mechanical action, so that its bulk is diminished, its capacity for heat is diminished, and more or less of its latent heat is converted into sensible heat. When a gaseous body like steam is mixed with a cold body like water, the steam is condensed to water again, and all its latent heat is imparted to water as sensible heat. Latent heat may therefore be rendered sensible either by mechanical or by chemical action, and it is not necessary to specify further the numerous ways in which this may be performed.

It must be borne in mind here that the terms *latent* and *sensible*, applied to heat, do not indicate any difference in essential quality, and it may be added, incidentally, that modern science tends strongly to substantiate the theory that heat is, to use the words of Helmholz, "simply a shivering motion of the ultimate particles of bodies."

We have seen that the thermometer does not indicate the total heat contained in bodies. Thus a pound of steam at atmospheric pressure and a pound of boiling water affects the thermometer equally, the mercury rising to 212° Fah.; but 5·3144 pounds of water at 32° Fah. may be mixed with this steam, making 6·3144 pounds of water at 212° Here the thermometer has stood at 212° during the entire experiment. It is evident, therefore, that the heat which has raised the temperature of the 5·3144 pounds of water from 32° to 212° was not at any time indicated by the thermometer.

A degree of the thermometer is not therefore a unit of heat.

It has been agreed to consider the amount of heat that will raise a pound of water one degree Fahrenheit, as the unit of heat. Experiment has shown this to be nearly a constant, at least sufficiently so for practical purposes. The heat developed by combustion may then be estimated by multiplying the weight in pounds of a mass of water into the number of degrees the temperature of the mass has been raised by the heat developed.

The experiments of Fabre and Silbermann were perhaps the most accurate ever performed to ascertain the total heat developed by the combustion of various substances.

The apparatus employed was a vessel of brass, gilt, and immersed in a vessel of silvered copper, containing about three and one half pints of water. This copper vessel was surrounded by a case filled with swan's down, to prevent loss by radiation, and this case was in turn surrounded by water in an outer chamber, so that even the small amount of heat that traversed the layer of swan's down should be intercepted. By these means it was found that the amount of heat absorbed by the atmosphere was reduced to a very small and measurable quantity.

The combustibles experimented upon were placed in the interior brass chamber, and were burned in pure oxygen previously dried and conveyed to the chamber through a tube, and the gases of combustion were made to traverse a spiral tube in the water until their temperatures were lowered to that of the water. Small pieces of lighted charcoal were used to ignite solid bodies, and liquids were burned in lamps with wicks of asbestos. Gases were introduced through jets previously lighted.

In this way the heat generated by the combustion of a large number of bodies was determined and tabulated.

The experiments of Joule have shown that the actual amount of heat developed by friction is dependent simply upon the force expended in producing the friction, and conversely it has been determined that the heat actually expended in performing a given amount of work is exactly proportional to the amount of work performed.

Joule has shown that raising the temperature of one pound of water one degree is equal to the mechanical power generated by the fall of a body weighing 772 pounds through one foot of space. This amount of work is called the *mechanical equivalent* of heat.

It will be evident now, that, knowing the amount of heat produced by a given weight of any kind of fuel, and the work performed by a steam engine under the boiler of which the combustion has been performed, that by comparing the actual work performed as measured by the dynamometer, with the total work the heat generated is capable of performing, as determined by the mechanical equivalent of heat, the percentage of heat converted into work by the engine may be also determined. On the average it is probable that this does not exceed ten per cent.

Playfair and De la Bèche found 13,873 units of heat to be the mean total per pound of seventeen different kinds of

English, Welsh, and Scotch coals. A bushel of coals weighing 84 pounds has been made to generate a mechanical effect of 120,000,000 foot-pounds, although probably not more than 100,000,000 are generally developed.

We find this article already too much extended to admit the discussion of the various methods adopted by Joule to to demonstrate the mechanical equivalent of heat. At some future time we will make these experiments the subject of another article.

EVERY PANE OF GLASS IS A HOLE TO HEAT.

The sentence which forms the caption of this article we remember from a popular lecture on heating and warming buildings, delivered by a man who has done much towards educating the American public on matters of domestic economy and hygiene.

Some of our correspondents are asking for information upon the subject of how the solar rays get through panes of glass without heating them. Even in the coldest weather when the glass is below zero in temperature, the heat of the sun passes in, and—we may also add—the radiant heat of a room passes out more or less, without materially altering the temperature of the glass.

The ultimate cause of this phenomenon, which, we may say, is not confined to glass alone, is not yet understood, although it is doubtless dependent upon the molecular structure of the glass. The properties of bodies by which they permit heat rays to pass through their structure freely is called diathermancy. This property glass possesses in a far less degree than many other substances.

The most remarkable diathermanous solid is rock salt. It permits heat from all sources to pass as readily through it as light passes through glass, and hence it has been called the "glass of heat." As a rule the most diathermanous bodies are transparent substances of little density, such as air and the gases. On the contrary, transparent substances of great density interfere with the passage of heat. Among these may be classed glass, rock-crystal, alum, water, heavy oils, etc.

Those bodies which intercept the passage of heat are called athermanous, but the terms diathermanous and athermanous are not very definite in their application, except when applied to bodies which transmit or intercept heat in a marked degree.

One of the most powerful athermanous bodies is alum. This substance is as remarkable in athermanous quality as rock salt is in its opposite character in this respect. Alum, although it be made into a very thin plate, transmits very little heat from any source, although it does not intercept light to any great extent. A piece of smoked quartz permits heat to pass quite freely, although scarcely any light can penetrate it. On the contrary, sulphate of copper, though it permits the passage of blue rays of light freely, almost totally intercepts the passage of heat.

These facts are well established by experiment, and a great many others of a similar character might be mentioned.

The formation of any good theory as to the causes of diathermancy and athermancy is rendered more difficult by the very peculiar modifications in the power of heat transmission consequent upon the source from which the heat is derived.

Thus while glass allows solar heat to pass without difficulty, and while, as above stated, it does not become heated in the rays of the sun, it will in a great measure intercept heat derived from terrestrial sources, and become itself heated. So we see that although "a pane of glass is a hole to heat," it is a hole through which heat enters more freely into than it flows out of an apartment.

It is, moreover, found that heat from various terrestrial sources passes through diathermanous bodies with different degrees of facility. Thus, plate glass will transmit no heat from copper at 212° Fah.; but from copper at 750° Fah. it transmits 6 per cent; of heat from ignited platinum it transmits 24 per cent; and from the naked flame of an argand oil lamp 39 per cent.

It is also found that the diathermancy of solids increases with the degree of polish of their surfaces. But what is most singular of all is that heat which has been transmitted through a diathermanous body is thereby rendered more transmissible through succeeding diathermanous bodies. Thus a larger per cent of the heat which has passed from a lamp flame through a glass chimney, will pass through another diathermanous body than would be transmitted from the naked flame.

These are only a few of the facts connected with this interesting subject. As we have said there is yet too little known of the molecular constitution of bodies to give ground for anything more than speculation as to the cause of the various degrees of facility with which substances transmit heat.

ENGINEERING PROJECTS.

Rapid and comfortable transit through New York seems to be a problem upon which many distinguished engineers are working. In addition to the Pneumatic Tunnel of which we have lately said so much, we now have it announced that the New York City Central Underground Railway is to be proceeded with at once. It is said that a contract for the construction and equipment of the road from the Battery to the Harlem River has been completed.

George B. McClellan, William J. McAlpine, Egbert L. Viele, Julius W. Adams, Sylvester Sweet, I. F. Quinby, and John B. Jarvis having been requested as a Board of Engineers "to consider the question of a subway under Broadway, in the City of New York, with the view of relieving that street from its present interruptions, and of affording a more convenient and speedy transit for passengers and for merchandise, without injury to the property upon the line of the street, or diversion of the established classes of business thereon," have submitted a report in which they say that a Sub-Arcade Railway will accomplish the objects desired. They think there are no difficulties attending the construction of the work which can not be overcome with engineering skill, and at a comparatively moderate cost; and that it meets a necessity in the most complete and unobjectionable manner. The estimated cost is from $1,600,000 to $2,000,000 per mile.

Marshall O. Roberts, William G. Ogden, Origon Vanderburgh, John I. Blair, Dudley Field, and John D. Sherwood, together with such persons as may become associated with them, have been created a body politic in deed and in law, by the name of the New York Port Submerged Railroad Company. They are empowered to survey, locate, and construct a submarine tunnel tube, or covered way, in or beneath the beds of the Bay of New York and of the Hudson River, from some point in New Jersey opposite the City of New York to some point in the City of New York, with one or more tracks herein to transport by rail or otherwise, freight and passengers, with the privilege of charging and collecting toll. They are not, however, to interrupt the free navigation of the waters. The penalties for obstructing or injuring such marine tunnel are a fine not exceeding $5,000 or imprisonment not less than sixty days, nor more than one year, or both, besides paying the amount of the damage.

SCIENTIFIC INTELLIGENCE.

THE NASCENT STATE.

For a long time chemists have been in the habit of employing the word "nascent" to indicate the birth of a body in certain decompositions. The precise meaning they ascribe to it has never been very clearly understood, but the word has been retained as a convenient one for hiding our ignorance. Professor Henry St. Claire Deville objects to its use; he thinks we ought to be able to give a precise and exact definition to every expression employed in science, and this is not possible with the word nascent. He states his reasons in an elaborate paper, an abstract of which we shall give to our readers hereafter.

MANUFACTURE OF FERRO-CYANIDE OF POTASSIUM.

Dr. Emil Meyer recently read a paper on this subject before the Chemical Society of Berlin, from which we make a few extracts:

By the heating and melting of animal matter with potash, only cyanide of potassium is produced; the ferro-cyanide is first formed by the action of the carbonate of iron or hydrated oxide of iron in the solution. This transformation is better accomplished in very dilute liquors. The author recommends the use of carbonate of iron prepared from the chloride by lime and warns against the presence of sulphuric acid. Pure carbonate of potash should also be selected. It is better to conduct the fusion at a high temperature with as much exclusion of the oxygen of the air as possible, and to introduce the animal refuse, previously dried, into the fused potash.

This important branch of industry is very little pursued in the United States, although the yellow ferro-cyanide of potassium has extensive applications.

REFINING CAMPHOR.

Crude camphor is adulterated with common salt, sulphur, vegetable matter, tar, and water. Its purification can be best accomplished by sublimation in glass flasks of a capacity of 8 to 10 pounds, at a temperature of 400° Fah. These flasks are made of thin glass with flat bottoms and short necks. They are put into a sand bath, where a uniform and rapid heat can be applied. The crude camphor is broken up, mixed with 3 to 5 per cent freshly-slaked lime and 1 to 2 per cent iron filings, well sifted and introduced through a funnel into the neck of the flasks. The flasks are then put into the sand bath, covered with sand to the neck, and heated gently for half an hour to expel the water. As the temperature increases, the camphor softens, and finally melts. After the whole mass has become fluid the sand is removed from the upper part of the flask and a paper stopper put in to partially close it. The heat is then carefully preserved at a point sufficient to sublime the camphor but not to re-melt it. In this way a very pure article can be obtained.

LIMIT OF THE HUMAN VOICE.

A learned professor, who appears to have had nothing better to do, has been making calculations of the distance to which the human voice would reach if it were as powerful in proportion to the size of the animal, as is the case with the grasshopper. The grasshopper makes himself heard $\frac{1}{16}$th of a mile. An ordinary man weighs as much as 26,000 of these insects, and if his voice were proportionately powerful could be heard for the distance of a thousand miles. Such an arrangement would enable us to dispense with the telegraph and facilitate the abolition of the franking privilege, as the honorable member from Smithtown could address his constituents directly from his seat in Congress; it might have its disadvantages, as, for example, if one were to accidentally sneeze, the roof of the house might be landed in the neighbor's lot, and the walls of the house be generally dislocated. Upon the whole, as "silence is golden," and the telegraph answers every purpose, we are satisfied with the present limit of the voice, and propose to leave the grasshopper in possession of the field.

NEW TESTS FOR PHOSPHORUS AND SULPHUR.

A German chemist, M. Schoen, suggests the following new tests: To detect phosphorus in organic or inorganic matter, mix the solid substance with half its weight of finely-divided magnesium, and heat in a glass tube closed at one end. The mixture becomes phosphorescent, the sides of the tube will be covered with red phosphorus and another portion of phosphorus will combine with the magnesium to form the phosphide of the metal. After cooling a few drops of water will evolve phosphureted hydrogen. As the magnesium will not combine with sulphur the search for this element can be made in the same mixture by sodium or potassium. All compounds of sulphur, whether organic or inorganic, are decomposed by potassium and sodium to form alkaline sulphides. Place the substance to be tested in the bottom of a small glass tube, put in a few pieces of sodium, and add another layer of the substance, and heat gently. After cooling, project the contents of the tube into acidulated water, when a disengagement of sulphureted hydrogen will at once betray the presence of sulphur, or the nitro-prusside of sodium will afford a purple coloration if any sulphur be present. These two tests are probably the most delicate of any hitherto suggested for the detection of phosphorus and sulphur.

SEPARATION OF COBALT.

Keep up the neutrality of the solution containing the chloride or sulphate of cobalt by suspending in it the carbonate of manganese, then pass sulphureted hydrogen gas through the boiling liquor, when all of the cobalt will be precipitated.

COMPOSITION OF THE TAM-TAM AND CYMBAL.

M. Riche, in his researches on alloys finds that the tamtam and cymbal are made of bronze that can be worked cold the same as iron or aluminum bronze. The best tone is produced by an alloy composed of 78 parts of copper and 22 parts of tin.

EXPLOSIVE COPPER COMPOUND.

Some years ago, when copper pipes were used for the conduction of illuminating gas through dwellings, small crystals were found to collect in the pipes, which proved to be highly explosive, and were shown on analysis to be composed of acetylene and copper. Recently a French chemist has discovered that the same explosive mixture can be produced by passing illuminating gas for some time through a solution of the nitrate of copper. The observation is a recent one, and may lead to the invention of a process for the manufacture of a new explosive compound.

Death of William W. Cornell.

This well known and highly esteemed citizen of New York died at his residence, on Washington Hights, on the 17th inst., of typhoid fever. Mr. Cornell began life depending entirely upon his own energies. He served a regular apprenticeship of seven years at the business in which he subsequently became distinguished. In 1847, in partnership with his brother, J. B. Cornell, he established his iron foundery, employing at first, by reason of the small capital possessed, but one man. The original manufactory was located on Center street. Here the business of the deceased gradually increased until at the end of ten years it had attained to such large proportions that it was necessary to move to another locality. During this year the firm constructed their great foundery on Twenty-sixth street, between Tenth and Eleventh avenues, and which has since remained the principal one owned by the brothers. Mr. Cornell's name is conspicuously associated with the progress of the use of iron as a building material, many of the best known edifices in the country having been constructed by him. Among them we can name the United States Custom House at Savannah, Ga., the Sun Atlantic Mutual Insurance Company, A. T. Stewart's, H. B. Claflin & Co's, Bank of New York, Bank of Commerce, Union Bank, Ball & Black's, and the New York *Herald* buildings. These are but a few of the many fine structures which will long remain monuments to the skill of the firm of J. B. & W. W. Cornell. Indeed, owning as the deceased did, the most extensive and completely equipped works in the United States for the construction of fireproof building, it is not surprising that he, with his brother, held the foremost position among our iron founders.

In his private life Mr. Cornell was distinguished for many sterling and amiable traits of character, and was very liberal in his gifts, especially to the Methodist Church, of which he was a member.

Re-Sharpening Files.

A very interesting and economical process has been exhibited before the Société d'Encouragement, of Paris, by M. Werdermann. Well-worn files are first carefully cleaned by means of hot water and soda; they are then placed in connection with the positive pole of a battery, in a bath composed of forty parts of sulphuric acid, eighty parts of nitric acid, and a thousand parts of water. The negative pole is formed of a copper spiral surrounding the files, but not touching them; the coil terminates in a wire which rises toward the surface. This arrangement is the result of practical experience. When the files have been ten minutes in the bath they are taken out, washed, and dried, when the whole of the hollows will be found to have been attacked in a very sensible manner; but should the effect not be sufficient, they are replaced for the same period as before. Two operations are sometimes necessary, but rarely more. The files thus acted upon are, to all appearance, like new ones, and are said to be good for sixty hours' work. M. Werdermann employs twelve medium Bunsen elements for his batteries.

At a single blast recently made at Reed's Gap, on the Air Line Railroad, near Wallingford, Conn., 604 cubic yards of solid rock were thrown out. Thirteen holes, fifteen feet deep and three and a half inches in diameter, were drilled. Nitroglycerin was the explosive.

U. S. Patent Office.

How to Obtain Letters Patent FOR NEW INVENTIONS.

Information about Caveats, Extensions, Interferences, Designs, Trade Marks; also, Foreign Patents.

FOR a period of nearly twenty-five years, MUNN & CO. have occupied the position of leading Solicitors of American and European Patents, and during this extended experience of nearly a quarter of a century, they have examined not less than fifty thousand alleged new inventions, and have prosecuted upward of thirty thousand applications for patents, and, in addition to this, they have made, at the Patent Office, over twenty thousand preliminary examinations into the novelty of inventions, with a careful report on the same.

The important advantages of MUNN & CO.'S Agency are, that their practice has been ten-fold greater than that of any other Agency in existence, with the additional advantage of having the assistance of the best professional skill in every department, and a Branch Office at Washington, which watches and supervises, when necessary, cases as they pass through official examination.

CONSULTATIONS AND OPINIONS FREE.

Those who have made inventions and desire a consultation are cordially invited to advise with MUNN & CO. who will be happy to see them in person at the office, or to advise them by letter. In all cases, they may expect an HONEST OPINION. For such consultations, opinion, and advice, NO CHARGE is made. A pen-and-ink sketch and a description of the invention should be sent.

TO APPLY FOR A PATENT,

A model must be furnished, not over a foot in any dimension. Send model to MUNN & CO., 37 Park Row, New York, by express, charges paid, also, a description of the improvement, and remit $16 to cover first Government fee, and revenue and postage stamps.

The model should be neatly made, of any suitable materials, strongly fastened, without glue, and neatly painted. The name of the inventor should be engraved or painted upon it. When the invention consists of an improvement upon some other machine, a full working model of the whole machine will not be necessary. But the model must be sufficiently perfect to show with clearness the nature and operation of the improvement.

PRELIMINARY EXAMINATION

is made into the patentability of an invention by personal search at the Patent Office, among the models of the patents pertaining to the class to which the improvement relates. For this special search, and a report in writing, a fee of $5 is charged. This search is made by a corps of examiners of long experience.

Inventors who employ us are not required to incur the cost of a preliminary examination. But it is advised in doubtful cases.

COST OF APPLICATIONS.

When the model is received, and first Government fee paid, the drawings and specification are carefully prepared and forwarded to the applicant for his signature and oath, at which time the agency fee is called for. This fee is generally not over $25. The cases are exceptionally complex if a higher fee than $25 is called for, and, upon the return of the papers, they are filed at the Patent Office to await Official examination. If the case should be rejected for any cause, or objections made to a claim, the reasons are inquired into and communicated to the applicant, with sketches and explanations of the references; and should it appear that the reasons given are insufficient, the claims are prosecuted immediately, and the rejection set aside, and usually **Without Extra Charge to the Applicant.**

MUNN & CO. are determined to place within the reach of those who confide to them their business, the best facilities and the highest professional skill and experience.

The only cases of this character, in which MUNN & CO. expect an extra fee, are those wherein appeals are taken from the decision of the Examiner after a second rejection; and MUNN & CO. wish to state very distinctly, that they have but few cases which can not be settled without the necessity of an appeal; and before an appeal is taken, in any case, the applicant is fully advised of all facts and charges, and no proceedings are had without his sanction; so that all inventors who employ MUNN & CO. know in advance what their applications and patents are to cost.

MUNN & CO. make no charge for prosecuting the rejected claims of their own clients before the Examiners and when their patents are granted, the invention is noticed editorially in the SCIENTIFIC AMERICAN.

REJECTED CASES.

MUNN & CO. give very special attention to the examination and prosecution of rejected cases filed by inventors and other attorneys. In such cases a fee of $5 is required for special examination and report, and in case of probable success by further prosecution, and the papers are found tolerably well prepared, MUNN & Co. will take up the case and endeavor to get it through for a reasonable fee, to be agreed upon in advance of prosecution

CAVEATS

Are desirable if an inventor is not fully prepared to apply for a Patent. A Caveat affords protection, for one year, against the issue of a patent to another for the same invention. Caveat papers should be carefully prepared.

The Government fee on filing a Caveat is $10, and MUNN & Co.'s charges for preparing the necessary papers are usually from $10 to $12.

REISSUES.

A patent when discovered to be defective, may be reissued by the surrender of the original patent, and the filing of amended papers. This proceeding should be taken with great care.

DESIGNS, TRADE MARKS, AND COMPOSITIONS

Can be patented for a term of years, also, new medicines or medical compounds, and useful mixtures of all kinds. When the invention consists of a medicine or compound, or a new article of manufacture, or a new composition, samples of the article must be furnished, neatly put up. Also, send a full statement of the ingredients, proportions, mode of preparation, uses, and merits.

PATENTS CAN BE EXTENDED.

All patents issued prior to 1861, and now in force, may be extended for a period of seven years upon the presentation of proper testimony. The extended term of a patent is frequently of much greater value than the first term; but an application for an extension, to be successful, must be carefully prepared. MUNN & Co. have had a large experience in obtaining extensions, and are prepared to give reliable advice.

INTERFERENCES

Between pending applications before the Commissioners are managed and testimony taken; also, Assignments, Agreements, and Licenses prepared. In fact, there is no branch of the Patent Business which MUNN & Co. are not fully prepared to undertake and manage with fidelity and dispatch.

FOREIGN PATENTS.

American inventors should bear in mind that five Patents—American, English, French, Belgian, and Prussian—will secure an inventor exclusive monopoly to his discovery among ONE HUNDRED AND THIRTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such, that patents can be obtained abroad by our citizens almost as easily as at home. MUNN & Co. have prepared and taken a larger number of European Patents than any other American Agency. They have Agents of great experience in London, Paris, Berlin, and other Capitals.

A Pamphlet, containing a synopsis of the Foreign Patent Laws, sent free. Address MUNN & CO., 37 Park Row, New York.

The Largest Newspaper Mail

Which goes to any one firm in this country, is received by G. P. Rowell & Co., the New York Advertising Agents. Their place of business is at No. 40 Park Row.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4·00 a year. Advertisements 17c. a line.

Important advance on the draft and easement of carriage. See Jackson's Patent Oscillating Wagon, with tests of draft, models, etc., No. 149 High st., Newark, Essex Co., N.J. See Scientific American, Sept.25, 1869.

Parallel Vise.—The most durable, labor-saving, and strongest, with the firmest hold. A. P. & M. Stephens & Co., 91 Liberty st., New York.

The "Anti-Friction" Horse Power is the best for driving every kind of farm or factory machinery. Send stamp for circular to R. H. Allen & Co., Postoffice Box 376, New York.

Our Catalogue of Agricultural and Horticultural Implements, machines, and tools (300 pages, 600 illustrations) is sent, postpaid, for $1. This is refunded on receipt of first order. R. H. Allen & Co., Postoffice Box 376, New York.

Photographs.—Rockwood & Co., 839 Broadway, for five dollars, make 8x10 photographs of machinery or views within the city.

Machinery Wanted.—Good Calender Mills, suitable for working India-rubber. Address (stating description and prices), Postoffice Box 3213, Boston, Mass.

A "Wood & Light" Patent Shafting Lathe, 28-in. swing, 25ft. bed, used 3 mos., at a sacrifice. E. P. Hampson, 38 Courtlandt st., N. Y.

An experienced master mechanic and draftsman desires an engagement. References unquestionable. Address Postoffice drawer 370 Watertown, N. Y.

Manufacturers of Oroid Watches will find a good wholesale customer by addressing J. N. Boylan, Detroit, Mich.

Adams & Lovell, 1105 State st., Erie, Pa., manufacturers of all kinds of wooden articles.

A practical machinist and draftsman wants a situation as draftsman. Best recommendation can be given. Address Eügon Walther, 1302 Coates st., Philadelphia.

A reliable man as machine shop superintendent can be heard from by addressing J. Q. Preble, 77 White st., New York.

Situation wanted.—A Pattern maker, who is a draftsman, desires a situation. Address C. F. L., box 576, Youngstown, Ohio.

Manufacturers and dealers in articles for family use from $1 to $5 will please send circulars with price to G.B.Bull, 333 Main st, Buffalo, N.Y.

A good business for a machine shop.—The right to manufacture, on royalty or otherwise, a first-class article already introduced; demand unlimited. Address Wm. Johnson, Lambertville, N. J.

Wanted—Machines to make chocolate. Send price list to Chas. Mueller, 185 Croghan st., Detroit, Mich.

Respirator.—Royalty for the manufacture of the same for sale by T. A. Hoffmann, Beardstown, Ill., Patentee. Send for circular.

I want to correspond with manufacturers of wood planing and molding machines. Please describe cutter head. T. N. Müller, Engineer, 698 3d avenue, New York.

Manufacturers and Dealers in the best machines for cutting or sawing veneering, address with circular, H. Burgett, Lewistown, Ill.

Machine wanted for digging wells. Address John W. Nale, Millville, N. J.

15,000 feet 7-16 round sticks, made direct from the board, with Hatch's Aggregate Molding machine, in one hour. W. D. Hatch, Antrim, N.H

Dickinson's Patent Shaped Carbon Points and adjustable holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24th, and Nov. 20, 1869. 64 Nassau st., New York.

All parties able to furnish second-hand or new hydraulic or other powerful presses, are requested to send details of price, power in tuns, measurement, and distance between plattens when open and when shut. Address Powers, 5 West 4th st., New York city.

Peck's patent drop press. Milo Peck & Co., New Haven, Ct.

1250 lbs. portable platform scales, $25; hay scales, 4-tun, $75. Send for free price list, No. 373. Edward F. Jones, Binghamton, N. Y.

American Boiler Powder.—A safe, sure, and cheap remedy for scale. Send for circular to Am. B. P. Co., P. O. Box 315, Pittsburgh, Pa.

Physicians of every school wanted to engage in an easy and lucrative office practice. For particulars, address W. C. Coburn, M.D., 868 Main st., Buffalo, N. Y.

Those desiring excellent copies of old daguerreotypes, tintypes, or card pictures, can have them made to their satisfaction by sending to John A. Whipple, 297 Washington st., cor. Temple Place, Boston, Mass.

Right For Sale.—Action and Reversion Water Wheel (self-governing). Will vent large or small volumes of water. Will retain its power under back water. Address William E. Hill, Erie, Pa.

Kidder's Pastilles.—A sure relief for Asthma. Price 40 cents by mail. Stowell & Co., Charlestown, Mass.

Needles for all sewing machines at Bartlett's, 569 Broadway, N Y.

For tool making, buy 15-in. engine lathes with taper attachment, made by the Pratt & Whitney Company, Hartford, Conn.

Pat. paper for buildings, inside & out, C. J. Fay, Camden, N. J.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

For first-quality new 14, 17, and 20-in. screw lathes, milling machines, and one-spindle drills, at small advance from cost, apply to Geo. S. Lincoln & Co., Hartford, Conn.

Hackle, Gill Pins, etc., at Bartlett's, 569 Broadway, New York.

Perforated Zinc and Sheet Iron for separators, smut machines grain dryers, tubular wells, malt kilns, etc. R. Aitchison & Co., Chicago

T. F. Randolph, Steam Model Works, Cincinnati, Ohio.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

Portable Pumping or Hoisting Machinery to Hire for Coffer Dams, Wells, Sewers, etc. Wm. D. Andrews & Bro., 414 Water st., N. Y.

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

Keuffel & Esser, 71 Nassau st., N.Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves

For tinmans' tools, presses, etc., apply to Mays & Bliss, Brooklyn, N. Y

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventative. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

Two 60-Horse Locomotive Boilers, used 5 mos., $1,300 each. The machinery of two 800-tun iron propellers, in good order, for sale by Wm. D. Andrews & Bro., 414 Water st., New York.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States. Terms $4·00 a year.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

All reference to back numbers should be by volume and page.

C. D. S., of N. Y.—The theory of the spheroidal shape of the earth has other foundation than the fact that a pendulum of given length oscillates more rapidly as we approach the poles. But suppose this were the only reason for the statement that the earth is a spheroid, it is sufficient. It is quite evident that you do not comprehend the fact that the resultant of the action of gravity on all the particles of masses is motion or pressure in right lines joining their centers, and that their attraction is directly as their masses and inversely as the square of the distances between their centers.

T. S., of N. Y.—There are devices used to determine the position of veins of gold, silver, etc., but they bear no analogy to the magnet. They are generally forked switches of witch hazel, etc., and we have no faith whatever in their efficacy. Such switches are called "divining rods."

R. O. S., of Del.—The term "air," used in works on painting, signifies the medium through which objects are viewed. The effect produced upon outline and color by air, in this meaning of the word, is an important element of art knowledge.

R. T. V., of N. J.—An expeditious and good method of reproducing from an engraving, a plate from which clear and distinct impressions can be taken, is much needed. None of the methods now used gives perfectly satisfactory results.

D. G. B., of Miss.—The disease called rust in wheat and other graniferous plants, is caused by the presence of minute fungi, a natural order of plants of a very low type, many of them parasitic, and a great number of them poisonous.

M. J. A., of N. Y.—The melting point of pure nickel is slightly less than that of iron. You should have had no difficulty in melting it in a brass-founder's furnace; perhaps you had instead of nickel some difficultly fusible alloy.

F. B. M., of N. Y., and others.—You will find a rule for computing proportions of safety valve and lever on page 16, current volume of the SCIENTIFIC AMERICAN.

D. N., of N. Y.—The oil referred to in the recipe for cement for leather, is raw linseed oil; the pitch, the common pitch used for caulking, etc.

R. S. T., of Minn.—The "gentles" spoken of by Izaak Walton are the larvæ of the common flesh fly, or, as they are commonly called, maggots.

J. S. & Co., N. Y.—We know of no paint that will dry so hard that it will not rub and mar. Asphaltum is what is generally used for edge tools.

A. C., of Ohio.—Your question is not clear. What do you mean by the end of the shaft of an overshot water wheel opposite the bucket end?

G. Y., of Mass.—The best way to convert the rapid rotation of a shaft into a slow rectilinear motion, is, for your purpose, the screw and rack.

F. C.—To make whitewash stick add to it a small proportion of glue, previously dissolved in hot water. Fish glue, or isinglass, is the best.

F. B. M., of N. Y.—We cannot give you the desired information in regard to Cazal's Electro-Magnetic Automator.

P. G., of Tenn.—The base of the substances called amides, is composed of one atom of hydrogen and two of nitrogen.

R. S., of La.—A saturated solution of common alum contains nearly ninety-one per cent of water by weight.

D. R. P., of Va.—Hematin is the red coloring principle of log wood.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

MORTISING MACHINE.—James Skipp, Newark, N. J.—This invention relates to a new and useful improvement in machines for mortising wood, and consists in the method of reversing the chisel, and in the mechanism connected therewith.

CAN FILLER.—N. L. Brundage and B. Downing, Pittston, Pa.—This invention relates to a new and useful improvement in an article for filling cans in the process of preserving fruits, meats, vegetables, and all similar articles.

LUMBER ELEVATOR AND WASHER.—S. E. Worrell, Quincy, Ill.—This invention reates to a new and useful improvement in machines for elevating or "drawing," and washing lumber, whereby the labor ordinarily required for that operation is greatly diminished, while the lumber is cleaned and suitably prepared for the planing machine.

CENTRIFUGAL GOVERNORS.—Thomas Moore, Brooklyn, N. Y.—This invention relates to a new and useful improvement in governors for regulating the speed of steam engines, and for all purposes to which it is applicable, whereby the governor is rendered more sensitive than governors of ordinary construction.

POCKET LOCK.—F. L. Roell, Northampton, Mass.—The object of this invention is to provide a safeguard against pickpockets, and it consists in arranging at the mouth or opening of the pocket, metallic rods, which are allowed to open and close, and are operated and adjusted by means of a sliding ring or rings.

HOTEL AND BURGLAR ALARM.—C. S. Noe, Bergen Point, N. J.—The object of this invention is to construct an electric hotel and burglar alarm, which from a single battery will charge a suitable number of wires, of which each will serve to operate the alarm when closed by a suitable switch, besides indicating on a dial or other plate the particular switch which was moved to produce the current.

SOFA BED.—John Needham, Morrisiana, N. Y.—This invention relates to a new and useful improvement in a combined sofa and bed, convertable from one to the other with the greatest facility.

SCREEN COAL HOD.—M. S. Nichols and Reuben Weaver, Central Village, Conn.—The object of this invention is to provide a coal hod which shall enable the user to sift or screen the coal from the ash, as the latter is taken from the stove or grate, and it consists in making the hod in two parts, one being a receptacle for coal and the other for the ashes.

MECHANICAL MOVEMENT.—William Garrison, Clarkstown, N. Y.—This invention relates to a new mechanism for converting oscillating into rotary motion and is chiefly applicable to machines for elevating or conveying heavy loads, by means of ropes or chains wound upon or unwound from rotating drums. The invention consists in such a combination of a pivoted lever with double pawls and two rotating geared drums, that at every oscillation of the lever the drums are both rotated in opposite directions.

DAMPER ACTION FOR PIANOFORTES.—A. H. Hastings, New York city.—This invention relates to a new manner of operating the dampers of upright pianofortes, directly by means of the keys, with an object of avoiding friction, and for producing more reliable action ;than could heretofore be obtained by the devices now in use.

LIFE STOOL.—H. T. Pratt, New York city.—This invention consists in providing stools for use on steamers and other vessels, adapted for use also as life preservers, the said stools being composed of a short, hollow cylindrical or other shaped part, made of paper, and two ends or heads of wood, one of which ends forms the seat, and the other the base ; also, when required, one or more handles, and a strap or cord for attachment to the body. The paper is used for the construction of the cylinder, because of its high capacity to resist the action of heat, cold and moisture ; also, because of its great strength and lightness.

COMPOUND FOR MAKING CONCRETE PAVEMENT.—Hiram M. Conklin, Carlstadt, N. J.—This invention relates to a new and useful compound for cementing gravel, sand, and other substances to form concrete pavements, roadways, and the like.

MACHINERY FOR REFITTING CONICAL VALVES.—Chas. F. Hall, Brooklyn, N. Y.—This invention relates to improvements in machinery for refitting the valves and valve seats of globe valves, and has for its object to provide machinery having greater efficiency than any now in use for the purpose. The invention consists in an arrangement of the stock of the conical mill or other formed cutting instrument for dressing the valves, whereby the same may be fed up to the valves by a positive feed device, and secured at any required position for the better finishing of the face of the valves, which when finished by the present implements are liable to have ridges or grooves, or be chattered in the said faces. It also consists in an arrangement of the tail stock for feeding and securinging in a similar way ; also, for rotating to turn the valves ; and also for adapting it for application to the guide used for attachment to the shell of the valve for supporting the reamer used for dressing the valve seat, whereby a similar positive feed may be imparted to the reamer, and be arrested for smoothening and finishing off the surface of the valve seat ; also, whereby the whole apparatus may be comprised in a fewer number of parts.

SKIVING MACHINE.—John Kavanagh and M. S. Moulton, Boston, Mass.—This invention relates to improvements in machines for skiving leather, and consists in the combination on a suitable stand of revolving wheels and adjustable cutters, under an arrangement whereby the leather to be skived, whether in straight or curved strips, may be attached to the faces of the said wheels, and drawn by turning them under the cutters supported near the said faces of the wheels, and pitched at any required angle, and operating to skive or bevel the edges.

BURGLAR-PROOF SAFE.—William McFarland, Williamsburgh, N. Y.—This invention has for its object to improve the construction of burglar-proof safes, in such a way that it will be impossible to blow powder through the joint between the door and body of the safe to blow the door open.

FIRE ESCAPE.—Michel Lewes and John C. Swenson, Williamsburgh, N. Y.—This invention has for its object to furnish a simple, convenient, effective, and reliable fire escape for permanent attachment to buildings, which shall be so constructed and arranged as not to interfere with the opening and closing of the blinds or shutters.

PIPE JOINT.—Robert B. Coar, Jersey City, N. J.—This invention has for its object to furnish an improved pipe joint, which shall be so constructed and arranged as to form a flexible joint, and one which, at the same time, will be close, and will not allow the pipe to be pulled apart.

INCLINE PLANE ELEVATOR.—Thomas B. Simonton, Williamsburgh, N.Y.—This invention has for its object to improve the construction of my improved elevator, patented November 24, 1868, and numbered 84,285, so as to adapt it for use upon the inclines of railways for carrying cars up and down said inclines.

FAUCET.—James Bulger, Port Sherman, Mich.—This invention has for its object to furnish a simple and convenient faucet, which shall be so constructed and arranged that the valve or cut-off may be within the cask so that no liquid can be left in the faucet to heat, sour, corrode, or freeze and so that it cannot be left open by inexperienced or careless persons.

COMBINATION WATER WHEEL.—John Fuller and Herbert Fuller, Lockington, Ohio.—This invention has for its object to furnish an improved combination water wheel, which shall be so constructed and arranged as to utilize the power that has heretofore been lost by the friction of the water upon the scroll or guide shoot, and at the same time enabling small wheels to be used so as to obtain the desired rapidity of motion without extra gearing.

CULTIVATOR.—Martin Bruner, Jr., Fremont, Ohio.—This invention has for its object to furnish an improved cultivator, which shall be so constructed as to bring the soil close up about the plants, and which will allow the plows to be easily, quickly, and conveniently raised and lowered as desired.

ADJUSTABLE WINDLASS.—John S. Brown, Schenectady, N. Y.—This invention relates to new and useful improvements in windlasses, for use on canal boats and on shipboard, and for all the purposes for which windlasses are employed.

GRAVEL PAN.—Henry Franke, Brooklyn N. Y.—The object of this invention is to provide an apparatus on which gravel or sand used for paving purposes, can be heated and dried in a continuous process. The invention consists in the construction of a system of heating flues, together with an open pan, in which the sand is contained, all parts being so arranged that the sand or gravel can be put into the pan at the top and taken out at the open sides ready for use.

SPOOLING GAGE.—R. H Norris, Paterson, N. J.—This invention relates to a new instrument for recording the length of silk or other thread, wound upon spools, and for sounding an alarm when the required length has been wound ; and also at certain desired intervals during the winding process.

FLOATING MILL POWER.—A. G. Heitmann, Brooklyn, N. Y.—This invention relates to a new apparatus for operating mills or other suitable machinery by the power of flowing or ebbing water, and consists chiefly in pivoting the superstructure on which the working machinery is set up, to a lower gate or float, and in suspending the paddle wheels by which the machinery is moved, between the said gate and the superstructure, so that by adjusting the distance between the two parts aforesaid, the amount of water acting on the paddle wheel may be regulated at will, and conformed to the amount of power required.

COOLING APPARATUS.—Theodore Gründmann, Cleveland, Ohio.—This invention relates to a new apparatus for cooling mash, beer, and other liquids, and consists in a novel arrangement of pipes, passages, and vessels for obtaining the desired result, namely ; the rapid and thorough cooling of the liquid, and the absolute discharge of the warmer cooling liquid.

GAS GENERATOR AND HEATER.—Henry Schminke, Baltimore, Md.—This invention relates to an apparatus intended for burning the vapor generated by heat from any hydro-carbon liquid, such as gasoline, and has for its object to utilize the heat of the burning jet in generating the vapor required to feed the same, and to prevent the impurities of the hydro-carbon from obstructing the flow of vapor.

CENTERING ATTACHMENT TO LATHES.—Daniel Kelly, Philadelphia, Pa.—This invention has for its object to provide an attachment to lathes, whereby the two processes of centering and drilling may be combined in one that is to say, simultaneously performed.

COURSE INDICATOR FOR VESSELS.—H. P. Tuttle, Brooklyn, N. Y.—This invention relates to a new instrument by whichthe true course of a vessel with regard to the variations of the needle, can be readily ascertained. The invention consis in the combination of two pointers or hands with a dial, the pointers turning on the same pin. They are so ground and held together that they will both move simultaneously, so that when one is set the other will also move unless held fast.

LOCK FOR SHIPS' PUMPS.—A. G. Ziesing, Weehawken, N. J.—This invention has for its object to provide a device by means of which the pumps in ships can be locked, to prevent their being used while so locked.

PAPER BOXES.—John Root, New Haven, Conn.—This invention relates to improvements in the manufacture of small, stiff, paper boxes, such as are used for matches and the like, and it consists in securing the turned up and lapped ends and sides by rivets driven through and clinched, in substitution for the present mode of pasting them together, which is very objectionable, on account of the time required to dry, and also because, owing to the nature of the work, it must be done by hand, whereas the riveting may be done by machinery.

LOOM.—Jas. Nuttall, Walmersley, England.—This invention relates to improvements in looms, and consists in an improved construction of pattern or tappet chain for actuating the harness levers or treadles.

GRINDING MILLS.—E. H. Vining, Covington, Ga.—The first part of this invention relates to an improved mode of feeding the grain from the hopper to the stones, and consists in the combination with a cup, arranged on the top of the balance iron, of a tube permanently connected to the bottom of the hopper, in the same vertical axis, and another tube having a telescopic connection with the first, and certain adjusting devices, whereby the feeding of the grain and the varying of the feed are effected with great uniformity. The second part of this invention relates to an improved alarm apparatus, for warning the miller when the grain is nearly out of the hopper, and consists in the combination with a strap of leather, or other flexible substance, traversing the bottom of the hopper, to be pressed down by the weight of the grain when the hopper is full, of a slide, bell-clapper, and bell, held out of action when the strap is covered with grain by the said strap, but let fall when the grain passes off the strap, so that the bell clapper will come in contact with the stone, and be agitated by it so as to strike the bell and give the alarm.

ATTACHING SOLES TO BOOTS AND SHOES.—C. S. Chaffee and Alex. Wahlig, Birmingham, Conn.—This invention relates to improvements in attaching soles to boots and shoes, and consists in attaching them by screws passed through eyelets formed in or connected to an endless wire, laid in a channel cut in the sole to sink the wire below the surface, the said eyelets being made to coincide with the holes formed for the screws, and the said holes being large enough to permit the screws to force them well down into them, so as to produce such tension on the wire as to cause it to hold the leather snugly to the insole between the holes.

CARBURETING APPARATUS.—Charles Lawrence, Cincinnati, Ohio.—This invention relates to improvements in the construction and arrangement of carbureting apparatus calculated to provide a more efficient and useful apparatus than any now in use. It consists in such an arrangement that the vapor is passed through a series of carbureting and condensing cells, or chambers, whereby the impregnation of the air with the vapor is more thoroughly accomplished, as also the condensation and separation of the moisture from the gas. The apparatus employed consists in a vessel of sheet metal of any preferred kind, divided perpendicularly into two general divisions, subdivided horizontally into compartments by perforated plates, through which the vapor and the air are forced together, and caused thereby to form the most perfect combination. One of the general divisions is a chamber to which the gasoline is admitted by a pipe. Near the bottom of the said chamber is provided a perforated plate, by which the air which is admitted through the bottom is spread and disseminated thoroughly throughout the gasoline. To further effect the said dissemination, a depression is formed in the bottom of the vessel around the mouth of the air pipe, and a perforated plate is placed over the same. Above this chamber is another chamber, separated therefrom by a perforated plate. This chamber is filled with sponge or any other prepared absorbent material, and through it the vapor of gasoline taken up by the air is passed, and the impregnating process thereby continued. From the latter chamber the vapor collects in the space above, passing through another perforated plate, from whence it is conveyed by a pipe to the bottom of the next general division of the apparatus, where it passes through a similar course, and passing therefrom into a third division, which is denominated the condensing division, passing this time downward through the perforated plates and absorbent material, into the space from which it is taken by a pipe, to the gasometer or to the gas mains. Patented March 8, 1870.

EXTENSION TABLE.—C. P. Lenz, Poughkeepsie, N. Y.—This invention consists in combining a bureau or case, containing drawers or shelves, with an extension table, the said bureau or case forming the support of the middle set of rails, and being thereby out of the way, and almost entirely out of sight.

SEED AND GUANO DRILL.—Alfred Iverson, Jr., Macon, Ga.—This invention relates to a combination of devices, including a hollow cylinder for holding seed or guano, or both, with a circumferential slot, through which the contents of the cylinder are dropped, as it is drawn along, subject to the regulation of an adjustable exterion shield, a fixed stirring finger within the cylinder, and an elastic coverer in the rear.

ADJUSTABLE CASTER.—John M. Vessey, Denver, Col.—This invention consists in adapting to the legs of tables, and especially sewing machine tables, casters, so combined with levers and inclosed in recesses, that when the table is to remain stationary, and a firm footing is desirable, in order tha it may not shake, the casters may be withdrawn so far within the recesses as not to touch the floor at all, and when the table is to be moved from place to place, the casters may be lowered so as to raise the table legs off the floor and leave the table supported entirely on the casters.

LAWN MOWER.—Joseph C. Field, Chicago, Ill.—This invention consists in so constructing a lawn mower, that the propelling power is applied to the shaft of the cutting cylinder, and so that the cutting cylinder may be revolved with a speed varying from that due to the forward motion of the machine, and by an application of power independent of the propelling power.

MACHINE FOR MANUFACTURING BITS.—James Swan, of Seymour, Conn.—This invention relates to a new and useful improvement in machinery for grinding the edges of auger bits and giving the outside "clear" to the lips, and consists, firstly, in a telescopic shaft and mandrel for holding, adjusting, and revolving the bit. Secondly, in a mechanism for varying the position of the bit with regard to the grinder or buzz, so as to give the proper out side "clear" to the tips of the bit, and, thirdly, in combination therewith an adjustable grindr of buzz, and the necessary mechanism for producing, the various motions.

GAGE FOR TOBACCO CUTTER.—W. N. C. Willson, Summit Point, W. Va.—This invention has for its object to gage, with accuracy, the quantity of tobacco, of different qualities, which the same amount of money will buy, and to secure uniformity in quantity, at different times, when the quality is the same.

MACHINE FOR SHAPING AND SEAMING SHEET METAL FOR ROOFING PURPOSES.—John M. Veasey, Denver, Col.—This invention has for its object to form sections of tin roofing, in trough shape, and with reflexed edges, in order to adapt them to convenient use.

RAILROAD GATE.—S. M. Snyder, Brady, Pa.—This invention has for its object to enable a railroad train to open, automatically, in advance of its passage, a gate placed across the track for preventing cattle from straying thereon to places whither they should not wander.

MANURE SPREADER.—Daniel Hill, New Vienna, Ohio.—This invention relates to a new machine for spreading manure and fertilizing materials upon fields, in suitable desired quantities, but evenly and without manual labor.

PROCESS OF WORKING CAST IRON INTO WROUGHT IRON.—Philemon Merryman and Robert McCombs, West Fairview, Pa.—This invention has for its object to separate cinder from iron, in puddling furnaces, and consists in drawing off the cinder at any time before the iron comes to a boil or ferment, and at any point below the foreplate.

Official List of Patents.

Issued by the United States Patent Office

FOR THE WEEK ENDING March 15, 1870.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT OFFICE FEES:

On each caveat	$10
On filing each application for a Patent (seventeen years)	$15
On issuing each original Patent	$20
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (three and a half years)	$10
On an application for Design (seven years)	$10
On an application for Design (fourteen years)	$30

In addition to which there are some small revenue-stamp taxes. Residents of Canada and Nova Scotia pay $500 on application.

For copy of Claim of any Patent issued within 30 years $1

A sketch from the model or drawing, relating to such portion of a machine as the Claim covers, from $1

upward, but usually at the price above-named.

The full Specification of any patent issued since Nov. 20, 1866, at which time the Patent Office commenced printing them $1.25

Official Copies of Drawings of any patent issued since 1836, we can supply at a reasonable cost, the price depending upon the amount of labor involved and the number of views.

Full information, as to price of drawings, in each case, may be had by addressing

MUNN & CO.,

Patent Solicitors, No. 37 Park Row, New York.

100,708.—COMBINED LOCK AND LATCH.—G. B. Allen, Norwalk, Conn.

100,709.—SHIP'S BLOCKS.—C. F. Annan, Boston, Mass.

100,710.—HAY-LOADER.—John Bachelder, Norwich, Conn.

100,711.—CHURN.—Timothy Baker, St. Johns, Mich.

100,712.—SLATE FRAME.—W. N. Bartholomew, Newton Center, Mass.

100,713.—CULTIVATOR TEETH.—Sanford Beckwith, Oskosh, Wis.

100,714.—COMBINATION LOCK.—Spencer Bentley and Charles Mee, Detroit, Mich.

100,715.—FARE REGISTER.—Frederick Blackburn and George W. Woodside, Philadelphia, Pa. Antedated February 28, 1870.

100,716.—STRAW-STACKING MACHINE.—William Boggs, Covington, Ohio.

100,717.—DETACHABLE HANDLE FOR KNIVES AND FORKS.—Leroy Boynton and W. F. Sweet, Jackson township, Pa.

100,718.—RAG-WHIPPER AND DUSTER FOR TREATING PAPER STOCK, ETC.—Leverett Brainard, Hartford, Conn.

100,719.—FAN AND PARASOL COMBINED.—Joshua Brooks, Boston, Mass. Antedated February 26, 1870.

100,720.—CULTIVATOR.—Martin Bruner, Jr., Freemont, Ohio

100,721.—FAUCET.—James Bulger, Port Sherman, Mich.

100,722.—MACHINE FOR SAWING LATH.—J. H. Butler, Hampden, Me. Antedated March 1, 1870.

100,723.—METHOD OF SECURING SOLES TO BOOTS AND SHOES—C. S. Chaffee and Alexander Wahlig (assignors to themselves and J. M. Goulding), Birmingham, Conn.

100,724.—BOOT AND SHOE SHAVE.—A. B. Clark, North Oxford, Mass.

100,725.—ENAMEL AND CLAY GAS RETORTS, BURNERS, TILES, ETC.—D. W. Clark, Chicago, Ill.

100,726.—PIPE JOINT.—R. B. Coar, Jersey City, N. J.

100,727.—CONCRETE AND WOODEN PAVEMENT.—W. B. Coates (assignor for one half his right to Joseph Leeds), Philadelphia, Pa.

100,728.—SAFETY ATTACHMENT FOR POCKETS.—H. R. S. Colton, Houghton, Mich.

100,729.—FERTILIZER.—John Commins, Charleston, S. C.

100,730.—COMPOUND FOR MAKING CONCRETE PAVEMENTS.—Hiram M. Conklin, Carlstadt, N. J.

100,731.—MACHINE FOR DRILLING AND TAPPING GAS FITTINGS.—R. T. Crane, Chicago, Ill.

100,732.—TURBINE WATER WHEEL.—E. F. Crocker, Niles, Mich. Antedated March 2, 1870.

100,733.—FOLDING-CHAIR.—J. C. Crummy and A. A. Parsons, Pittsburg, Pa. Antedated February 25, 1870.

100,734.—COMBINED LATCH AND LOCK.—C. L. Dean, Newark, N. J.

100,735.—AUTOMATIC CRADLE.—S. G. Delano, Argentine, Mich.

100,736.—APPARATUS FOR THE PRODUCTION OF OZONE.—C. F. Dunderdale, New York city.

100,737.—APPARATUS FOR FORCING AIR INTO CARBURETERS ON RAILROAD CARS.—C. F. Dunderdale, New York city.

100,738.—RAILWAY RAIL JOINT.—E. P. Dwight, Philadelphia, Pa.

100,739.—GATE.—Thomas Ellison, Abingdon, Ill.

100,740.—CORN HUSKER.—N. Evinger, Sandford, Ind.

100,741.—BURGLAR-PROOF SAFE.—J. M. Ewing, Hastings, Mich.

100,742.—LAWN MOWER.—J. C. Field, Chicago, Ill.

100,743.—PLOW.—Miranda Fort, Talbatton, Ga.

100,744.—CIGAR PIERCER.—H. N. Foster, East Greenwich, R. I.

100,745.—GRAVEL PAN.—Henry Franke, Brooklyn, N. Y.

100,746.—COMBINATION WATER WHEEL.—John Fuller and Herbert Fuller, Lockington, Ohio.

100,747.—MECHANICAL MOVEMENT.—Wm. Garrison, Clarkstown, N. Y.

100,748.—CORN PLANTER.—William Gilman, Ottawa, Ill.

100,749.—MACHINE FOR STAMPING LACE PAPER.—Ambrose Giraudat, New York city.

100,750.—STEERING APPARATUS.—E. G. Green, East Gloucester, Mass.

100,751.—COPING FOR WALLS.—John Grindrod, Albany, N. Y.

100,752.—APPARATUS FOR COOLING BEER AND OTHER LIQUIDS.—Theodore Gründmann, Cleveland, Ohio. Antedated March 5, 1870.

100,753.—DEVICE FOR OPERATING CHURNS.—Edgar R. Hall and Wm. H. Town (said Hall assigns his right to said Town), Syracuse, N. Y.

100,754.—METHOD OF STRENGTHENING BOBBINS OR SPOOLS.—Albert Hallowell (assignor to himself, A. T. Atherton, and H. T. Durgin), Lowell, Mass.

100,755.—PAPER-MAKING MACHINERY.—Wm. W. Harding, Philadelphia, Pa.

100,756.—ROCK-DRILLING MACHINE.—Jacob Hart, Savannah, Mo.

100,757.—SCREW-DRIVER.—Lewis Hart, Unionville, Conn.

100,758.—FARE BOX FOR RAILROAD CARS.—Geo. C. Hathorn, New York city.

100,759.—GATE.—James Hays, Fostoria, Ohio.

100,760.—MEDICAL COMPOUND FROM CHLORAL.—T. H. Hazard, Richmond, Va.

100,761.—FLOATING-MILL POWER.—A. G. Heitmann (assignor to himself and James Kelly), Brooklyn, N. Y.

100,762.—MANURE SPREADER.—Daniel Hill, New Vienna, Ohio, assignor to himself and Isaac I. Evans, Richmond, Ind.

100,763.—WINDOW CORNICE.—Robert N. Hoffman, Chicago, Ill.

100,764.—FEEDING MECHANISM FOR SEWING MACHINES.—J. A. House, Bridgeport, Conn.

100,765.—KNITTING MACHINE.—J. M. Howe, Rochester, N. Y.

100,766.—CONDENSER AND LIME-EXTRACTING HEATER.—John Huntington, Cleaveland, Ohio.

100,767.—HORSE HAY FORK.—T. D. Ingersoll, Monroe, Mich.

100,768.—HORSESHOE.—Hiram Ingraham, Armada, Mich.

100,769.—HOISTING MACHINE.—Joseph Jewsbury, Brook Fields, England, assignor to H. A. Clarke, Boston, Mass.

100,770.—STUMP EXTRACTOR.—W. O. Johnson, Alma, Mich.

100,771.—SKIVING MACHINE.—John Kavanagh, Providence, R. I., and Moses S. Moulton, Boston, Mass.

100,772.—CENTERING ATTACHMENT FOR LATHE.—Daniel Kelly (assignor to himself and Walter K. Ludwig), Philadelphia, Pa.

100,773.—APPARATUS FOR LIGHTING GAS BY ELECTRICITY.—W. H. Kelly, New York city.
100,774.—VAPOR BURNER.—Isaac Kling, Seymour, Ind.
100,775.—MACHINE FOR MAKING FRUIT CANS.—Isaac Kling, Seymour, Ind.
100,776.—EXTENSION TABLE.—Chas. P. Lenz, Poughkeepsie, N. Y.
100,777.—FIRE ESCAPE.—M. Lewis and J. C. Swenson, Williamsburgh, N. Y.
100,778.—MACHINE FOR CLEANING STABLES.—T. F. Longaker, Philadelphia, Pa.
100,779.—ANIMAL TRAP.—M. W. Lyman, Chicago, Ill.
100,780.—PLOW.—T. T. Mattox, Griffin, Ga.
100,781.—BURGLAR-PROOF SAFE.—Wm. McFarland, Williamsburgh, N. Y.
100,782.—BASIN WITH WASTE-PIPE ATTACHMENTS.—G. C. Miller, Goshen, and J. H. Coates, New York city.
100,783.—DIE FOR FORMING PERCH PLATES.—R. R. Miller, Plantsville, Conn.
100,784.—CIRCULAR SAW MILL.—Jonathan Mills and A. G. Waldo, Milwaukee, Wis. Antedated Feb. 28, 1870.
100,785.—GOVERNOR FOR STEAM ENGINES.—Thomas Moore, Brooklyn, N. Y.
100,786.—SIPHON.—S. S. Moyer, Allentown, Pa.
100,787.—FARM GATE.—Joseph H. Murphy and Patrick J. Murphy, Abingdon, Ill.
100,788.—MODE OF PREVENTING THE STEALING OF BONDS, ETC.—J. Myers, Jr., Brooklyn, E. D., N. Y.
100,789.—SOFA BED.—John Needham, Morrisania, N. Y.
100,790.—BUCKWHEAT HULLING MACHINE.—Thomas Nelson, (assignor to Newton Reynolds and H. G. Nelson), Troy, N. Y. Antedated March 3, 1870.
100,791.—SCREEN COAL HOD.—M. S. Nichols and Reuben Weaver, Central Village, Conn.
100,792.—HOTEL AND BURGLAR ALARM.—C. S. Noe, Bergen Point, N. J.
101,793.—SPOOLING GAGE.—R. H. Norris, Paterson, N. J.
100,794.—TAPPET CHAIN FOR LOOM.—James Nuttall, Walmersley, England, assignor to T. Isherwood and C. Maxon, Westerly, R.I. Antedated March 4, 1870.
100,795.—COAL CAR AND TRUCK WHEELS.—John Patterson, Pittsburgh, Pa.
100,796.—PRESSER-FOOT FOR SEWING MACHINES.—Wm. W. Pettee, Foxborough, Mass.
100,797.—VENTILATOR.—W. E. Phelps, Elwood, Ill.
100,798.—KNITTING MACHINE.—Frank Philip, Stockport, N. Y., assignor to Hamilton E. Towle and George Ed. Harding, New York city.
100,799.—WRITING SLATE.—George Edwin Poor, Charlestown, Mass.
100,800.—RIDING ATTACHMENT FOR PLOWS.—A. E. Porter and A. L. Porter, Lamoille, Ill.
100,801.—LIFE PRESERVING STOOL.—H. T. Pratt, New York city.
100,802.—THILL COUPLING.—G. W. Price, Adrian, Mich.
100,803.—CLOTHESLINE HOLDER.—John C. Rankin, Mount Vernon, N. Y.
100,804.—HAY RAKE AND LOADER.—G. H. Reister, Washington, Iowa. Antedated Feb. 26, 1870.
100,805.—SAFETY ATTACHMENT FOR POCKETS.—F. L. Roell, Northampton, Mass.
100,806.—PAPER BOX.—John Root (assignor to himself and Andrew Martin), New Haven, Conn.
100,807.—VAPOR BURNER FOR COOKING OR HEATING.—H. S. Saroni, Baltimore, Md.
100,808.—WASHING MACHINE.—E. B. Scattergood, St. John's, Mich. Antedated March 11, 1870.
100,809.—GRATER.—Leonard Schmidt, Lancaster, Pa.
100,810.—KNITTING MACHINE.—Henry Batchford Scudder, Needham, Mass.
100,811.—INCLINE PLANE ELEVATOR.—T. B. Simonton, Williamsburgh, N. Y.
100,812.—CULTIVATOR.—J. B. Skinner, Rockford, Ill.
100,813.—MORTISING MACHINE. — James Skipp, Newark, N. J.
100,814.—STEAM ENGINE SLIDE VALVE.—A. J. Stevens, San Francisco, Cal. Antedated March 5, 1870.
100,815.—COMBINED CORN MARKER, PLANTER, AND CULTIVATOR.—Wm. Stirk, Fort Wayne, Ind.
100,816.—MACHINE FOR BENDING THE LIPS OF AUGER BITS.—Jas. Swan, Seymour, Conn.
100,817.—HARVESTER.—P. A. Tobey (assignor for one half his right to S. Tobey), Caton, N. Y.
100,818.—HORSE-POWER.—P. A. Tobey (assignor for one half his right to S. Tobey), Caton, N. Y.
100,819.—CHECK PIECE AND SHROUD YOKE FOR SHIPS' RIGGING.—Henry Townsend, Philadelphia, Pa.
100,820.—PADDLE WHEEL.—Benjamin W. Tooker, Brooklyn, N. Y.
100,821.—HAND INDICATOR FOR SHOWING THE COURSE OF VESSELS.—H. P. Tuttle, Brooklyn, N. Y.
100,822.—VEGETABLE SCOOP.—John F. Unglish, Webster, N. Y.
100,823.—DIE FOR MAKING CLINCH RINGS.—Samuel Vanstone, Providence, R. I.
100,824.—GRINDING MILL.—E. H. Vining, Covington, Ga.
100,825.—DIE OR FORMER FOR MAKING DOUBLE-SHINNED MOLDBOARD BLANKS FOR PLOWS.—W. M. Watson, Tonica, Ill.
100,826.—LADLE FOR PORING METALS.—A. S. Wells, New Britain, Conn.
100,827.—HORSE POKE.—Geo. Whitbeck, Phelps, N. Y.
100,828.—LIFTING JACK.—F. C. White, Euclid, Ohio.
100,829.—SLUICE BOX FOR GOLD MINING.—J. H. Whitney, Helena, Montana Territory. Antedated March 5, 1870.
100,830.—REVERSIBLE KNOB LATCH.—Joseph Whittingham, Pittsburgh, Pa.
100,831.—APPARATUS FOR WASHING AND ELEVATING LUMBER.—Stanley E. Worrell, Quincy, Ill.
100,832.—ELEVATOR.—M. L. Wyman, Melrose, assignor to O. Tufts, Boston, Mass.
100,833.—LOCK FOR SHIPS' PUMPS.—A. G. Ziesing, Wehawken, N. J.
100,834.—TRACK-LAYING MACHINE.—J. R. Adams, San Francisco, Cal.
100,835.—APPARATUS FOR DRYING AND EVAPORATING.—C. Alden, Newburg, N. Y.
100,836.—SPOKE LATHE.—G. F. Almy, Toledo, Ohio.
100,837.—RAILWAY CAR COUPLING.—S. J. Anderson, Cazenovia, N. Y.
100,838.—CENTRIFUGAL PUMP.—William Draper Andrews, New York city.
100,839.—FRICTION WHEELS FOR GEARING.—W. D. Andrews, New York city.
100,840.—LAWN MOWER.—Joseph Arbeiter, East Hartford, assignor to Samuel Colt, Hartford, Conn.
100,841.—STEAM ENGINE.—John S. Barden, Providence, R. I.
100,842.—BELT-SHIPPING MECHANISM FOR SPINNING JACKS.—Joseph Baron, Millbury, Mass.
100,843.—HEDGE FENCE.—A. Belt, Newtown, Iowa.
100,844.—DETERGENT COMPOUND.—William Berry, Boston, Mass., assignor to himself, George W. Belcher, and William G. McLeod.
100,845.—LANTERN.—W. J. Berry, Brooklyn, N. Y.
100,846.—LIFTING JACK.—L. J. Blades, Harrington, and J. Mahoney, Wilmington, Del.
100,847.—STEAM ENGINE GOVERNOR. — Horace Boardman, Port Richmond, N. Y.
100,848.—CARVING WOOD.—Myron T. Boult, Battle Creek, Mich.
100,849.—APPARATUS FOR MAKING EXTRACTS AND DECOCTIONS FROM COFFEE, TEA, AND OTHER SUBSTANCES.—Louis Brauer, Washington, D.C.
100,850.—CIGAR SHIELD.—George E. Brinkerhoff, New York city.
100,851.—FUNNEL CAN FILLER.—N. L. Brundage and B. Downing, Pittston, Pa.
100,852.—PORTABLE BEER COOLER.—E. C. Bundy, Oneonta, N. Y.
100,853.—CULINARY BOILER.—F. M. Carnes (assignor to Giles Carter and Smith Carpenter), Rochester, N. Y.
100,854.—POTATO DIGGER.—H. C. Carr, Bordentown, N. J.
100,855.—WOOD-TURNING LATHE.—James Chase, Rochester, N. Y.
100,856.—HAY TEDDER.—T. J. Clark and G. M. Clark, Higganum, Conn.
100,857.—EGG CARRIER.—W. J. Clark, Lena, Ill.
100,858.—STAIR ROD.—W. M. Clayton, New York city.
100,859.—CAPSTAN.—D. N. B. Coffin, Jr., Newtown Center, Mass.
100,860.—RAILWAY CAR AXLE.—Charles Cole, Troy, N. Y., assignor to himself and Harvey Cole, Hartford, Conn.
100,861.—HAY AND COTTON PRESS.—R. H. Cole and G. F. Cole, Greenport, N. Y.
100,862.—ORANGE KNIFE.—Edward L. Cooke, Hartford, Conn.
100,863.—CULINARY VESSEL.—C. E. Corbett, Binghampton, N. Y.
100,864.—BODY LOOP FOR CARRIAGES.—Fredrick A. Cowles, Plantsville, assignor to himself and J. B. Savage, Southington, Conn.
100,865.—PAPER BOX.—C. O. Crosby, New Haven, Conn.
100,866.—PHOTOGRAPHIC PLATE DIPPER.—D. H. Cross, Bennington, Vt.
100,867.—DEPURATOR.—Wm. Curran, St. Louis, Mo.
100,868.—VISE.—R. J. Cushing, Bowdoinham, Me.
100,869.—PLOW.—M. K. Dahl, Waupun, Ill.
100,870.—RAILROAD CAR VENTILATOR.—Samuel Darling, Providence, R. I.
100,871.—MANUFACTURE OF FERTILIZERS.—J. Y. Diaz, Havana, Island of Cuba.
100,872.—LATCH.—S. W. Drowne, Norwich, Conn.
100,873.—CARRIAGE WHEEL HUB.—Jacob Dump, Kingston, Conn.
100,874.—STILL FOR DISTILLING HYDROCARBONS.—J. B. Edwards, North Greenbush, N. Y.
100,875.—MODE OF LUBRICATING THE WHEELS IN TREAD POWERS.—S. D. Ely, Millstone, N. J.
100,876.—PROCESS OF TREATING ACID RESIDUUM FROM OIL REFINERIES.—Alonzo Farrar, Brookline, Mass.
100,877.—COMPOSITION, TO BE USED FOR PRINTING OR PAINTING ON SURFACES.—Alonzo Farrar, Brookline, Mass.
100,878.—Division A. — MACHINE FOR MANUFACTURING HARVESTER GUARD FINGERS.—Jerome Fassler, Springfield, Ohio.
100,879.—NEEDLE CASE.—W. B. Field, Rockville, and Burroughs Beach, Meriden, Conn.
100,880.—COFFEE POT.—J. F. Fitch, B. G. Devoe, and R. W. B. McLellan, Vandalia, Ill., said McLellan assigns his right to said Fitch and Devoe. Antedated March 11, 1870.
100,881. PROCESS OF MAKING GLASS SIGNS, SHOW CARDS ETC.—Christian Flammer, Chicago, Ill.
100,882.—COMBINED CARRIAGE, CRADLE, SWING, AND BABY WALKER.—W. H. Flanigan, Philadelphia, Pa.
100,883.—AUTOMATIC BOILER FEEDER.—Elisha H. Goldman, Clayton, Ind.
100,884.—TORPEDO AND CARTRIDGE.—Edwin Gomez, New York city.
100,885.—PUMP.—D. J. Gorton (assignor to himself and W. E. Gorton) West Eau Claire, Wis.
100,886.—SUSPENDER.—B. J. Greely (assignor to T. O. Potter and J. W. Smith), Boston, Mass.
100,887.—APPARATUS FOR ELEVATING AND BAGGING GRAIN.—J. S. Hasbrouck, Tyre, N. Y.
100,888.—DAMPER FOR PIANOFORTE.—A. H. Hastings, New York city. Antedated March 5, 1870.
100,889.—PACKING APPARATUS. — Cornelius E. Haynes, Boston, Mass.
100,890.—LEATHER SCARFING MACHINE.—Charles H. Helms, Poughkeepsie, N. Y.
100,891.—LATHE FOR SETTING JEWELS IN TIME PIECES.—H. H. Haskett, McLean county, Ill.
100,892.—MANUFACTURE OF BRICKS.—G. S. Hewitt, Boston, Mass.
100,893.—ELEVATED RAILWAY.—B. L. Hood, H. O. Hood, and E. W. Clark, Jr., Washington, D. C.
100,894.—SADDLE.—George Horter (assignor to himself T. K. Peterson, and E. C. Fenner), New Orleans, La.
100,895.—JOINT FOR FISHING RODS.—W. J. Hubbard, Ansonia, Conn.
100,896.—PIPE COUPLING FOR HEATING AND VENTILATING RAILROAD CARS.—F. R. Hunt, Leavenworth, Kansas.
100,897.—PACKAGE BAND AND FASTENER.—F. R. Hunt, Leavenworth, Kansas.
100,898.—SEED AND GUANO DRILL.—Alfred Iverson, Jr., Macon, Ga.
100,899.—HASP AND STAPLE FASTENING.—E. P. Jones, Shell Mound, Miss.
100,900.—RAILWAY CAR BRAKE.—E. P. Jones, Shell Mound, Miss.
100,901.—WAGON BRAKE.—Edward P. Jones, Shell Mound, Miss.
100,902.—MANUFACTURE OF STAVE BASKET.—H. C. Jones, Dowagiac, Mich.
100,903.—MACHINE FOR BENDING FIFTH WHEELS.—Wm. J. Jordan, New Lisbon, Ohio.
100,904.—BINDING ATTACHMENT FOR SEWING MACHINES.—A. C. Kasson, Milwaukee, Wis.
100,905.—REVOLVING, ROCKING, AND RECLINING CHAIR.—George Knell, Moorestown, N. J.
100,906.—LIFE PRESERVER.—Camille Krejci, Scranton, Pa.
100,907.—APPARATUS FOR WORKING HIDES.—Henry Lampert, Rochester, N. Y.
100,908.—FANNING AND SMUT MILL.—Horace Littlefield, Lewis, Iowa.
100,909.—NEEDLE-ADJUSTING BLOCK FOR SEWING MACHINES.—T. A. Macaulay, Northampton, Mass.
100,910.—DRAWBRIDGE.—Neil Macneale, Cincinnati, Ohio.
100,911.—FEATHER WASHER AND DRYER.—John Mallory, Penn Yann, N. Y.
100,912.—MACHINE FOR SPINNING SHEET METAL.—John J. Marcy (assignor to himself and E. Miller & Co.), Meriden, Conn.
100,913.—SMUT MILL.—D. W. Marmon (assignor to Nordyke, Marmon, & Co.), Richmond, Ind.
100,914.—FRUIT DRYER.—J. B. May, Magnolia, Ohio.
100,915.—PRODUCTION OF LIGHT FROM HEAVY HYDROCARBONS.—R. S. Merrill, Cambridge, assignor to W. B. Merrill and Joshua Merrill, Boston, Mass.
100,916.—PUDDLING PROCESS FOR MAKING WROUGHT IRON.—Philemon Merrymen and Robert McCombs, West Fairview, Pa.
100,917.—RAILWAY RAIL.—James Millholland, Reading, Pa.
100,918.—ICE-CREAM FREEZER.—Thos. Mills and G. M. Mills, Philadelphia, Pa.
100,919.—FENCE.—David Mitchell, New Berlin, Pa.
100,920.—WATER-WHEEL.—A. F. Murray and Henry Green, Moline, Ill.
100,921—HANDLE FOR TABLE CUTLERY.—J. H. Nichols and Wm. Bower, Beaver, Pa.
100,922.—HARVESTER RAKE.—Aaron Palmer and C. W. Palmer, Brockport, N. Y.
100,923.—WASHING MACHINE.—G. W. Putnam, South Glens Falls, N. Y.
100,924.—MODE OF PRODUCING PHOTO-LITHOGRAPHIC TRANSFERS.—Isaac Rehn, Washington, D. C., . signor to himself and Norris Peters.
100,925.—FOLDING CRIB AND CRADLE.—D. M. Reynolds, Chicago, Ill.
100,926.—SPIRAL SPRING FOR RAILWAY CARS.—F. W. Rhinelander, New York city.
100,927.—MACHINE FOR PREPARING WOOD FOR INLAYING.—C. F. Ritchel, Newark, N. J.
100,928.—MACHINE FOR HEADING BOLTS.—John Root (assignor to himself and McLagon & Stevens), New Haven, Conn.
100,929.—MACHINE FOR CORRUGATING SHEET METAL.—Franklin Roys, East Berlin, Conn.
100,930.—VAPOR BURNER.—Henry Schminke, Baltimore, Md.
100,931.—CATARRH REMEDY OR SNUFF.—Thos. C. Scruton, Farmington, N. H.
100,932.—SCRUBBING BRUSH.—John See, Philadelphia, Pa.
100,933.—BURGLAR ALARM.—Reuben Shaler, Madison, Conn.
100,934.—MECHANISM FOR OPERATING SEWING MACHINES.—Elisha Shiver, Washington, D. C.
100,935.—MECHANISM FOR DRIVING SEWING MACHINES.—Elisha Shivar (assignor to J. H. McBlair), Washington, D. C.
100,936.—EXTRACTING TURPENTINE FROM PINE TREES.—J. C. Shuler, Cane Hoy, S. C.
100,937.—METALLIC ALLOY TO IMITATE THE PRECIOUS METALS.—Lorenzo Sibert, Staunton, Va.
100,938.—SPOON HOLDER.—Samuel Simpson, Wallingford, Ct.
100,939.—MAN-HOLE PLATE FOR TANNERY STUFFING WHEEL.—Henry Smith, Jr., Milwaukee, Wis.
100,940.—RAILROAD CONDUCTORS' TICKET CASE.—Joseph T. Smith, Louisville, Ky.
100,941.—CORN HUSKER.—T. S. Smith, Cincinnati, assignor to himself and O. H. P. Anderson, Salem, Ohio.
100,942.—WATER-WHEEL REGULATOR.—H. D. Snow, Bennington, Vt. Antedated March 11, 1870
100,943.—RAILWAY GATE.—S. M. Snyder, Brady, Pa.
100,944.—MANUFACTURE OF CEMENT FOR ARTIFICIAL STONE.—Stanislas Sorel, Paris, France, assignor to J. F. Wood, Boston, Mass.
100,945.—MANUFACTURE OF ARTIFICIAL STONE.—Stanislas Sorel, Paris, France, assignor to J. F. Wood, Boston, Mass.
100,946.—COMBINED CURRENT-WHEEL AND CONDENSING ENGINE.—Hatherly Spear, Cape Elizabeth, Me.
100,947.—HEATING ATTACHMENT FOR STEAM BOILERS.—Elihu Spencer, Elizabeth, N. J.
100,948.—IRON FRAME FOR UPRIGHT PIANOS.—Geo. Steck, New York city.
100,949.—WRAPPING SCYTHES FOR TRANSPORTATION.—Lovett Stimson (assignor to the Greenwoods Scythe Company), New Hartford, Conn.
100,950.—HORSE RAKE.—J. C. Stoddard, Worcester, Mass.
100,951.—THILL COUPLING.—Chauncey Thomas, Boston, Mass. Antedated March 3, 1870.
100,952.—ASH SHOVEL.—R. J. S. Thompson, Washington, Pa.
100,953.—MANUFACTURE OF ROSIN OIL.—Joseph Treat, New York city.
100,954.—COMPOSITION FOR CONCRETE PAVEMENTS, WALKS, ETC.—A. Van Camp, Washington, D. C., and M. M. Hodgman, St. Louis, Mo.
100,955.—COMBINED HEDGE TRIMMER AND MOWER.—Geo. Waddington, Le Roy, Ill.
100,956.—LANDAU CARRIAGE DOOR.—Edward Wells, New Haven, Conn.
100,957.—PLOW.—R. J. Wheatley, Duquoin, Ill.
100,958.—AUTOMATIC CAR BRAKE.—Marmaduke Wilkin and John Clark, London, England.
100,959.—GAGE FOR TOBACCO CUTTER.—W. N. C. Willson, Summit Point, West Va.
100,960.—CAR BRAKE AND STARTER.—E. P. Jones, Shell Mound, Miss.

REISSUES.

3,878.—SAW MILL.—A. P. Barlow, C. H. Eastman, W. W. King, Z. B. Small, and J. H. Johnson, Claremont, N. H., assignees of A. P. Barlow.—Letters Patent No. 72,155, dated December 17, 1867.
3,879.—AUGER.—I. T. Payne, Chester, Conn.—Letters Patent No. 75,454, dated March 10, 1868; antedated February 28, 1868.
3,880.—PADLOCK.—F. W. Smith, Jr., Bridgeport, Conn., Geo. W. Bassett, New York city, and S. R. Wilmot, Bridgeport, Conn., assignees of Frederick Egge.—Letters Patent No. 88,377, dated Feb. 2, 1869.

DESIGNS.

3,895.—ARTIFICIAL FLOWER.—C. S. Baldwin, New York city.
3,896 and 3,897.—FLOOR CLOTH PATTERN.—Hugh Christie, Morrisania, assignor to W. M. Brasher & Co., Brooklyn, N. Y. Two patents.
3,898.—PATTERN OR CHART FOR APPLYING MEASUREMENTS AND LAYING OUT DRESS WAISTS.—Willett Cornwell and Elmira Cornwell, Rochester, Minn.
3,899.—CHILDREN'S CARRIAGE.—Geo. H. Mellen, New York city.
3,900.—CLOCK FRONT.—Nicholas Muller, New York city.
3,901 to 3,905.—TYPE.—W. H. Page, Norwich, Conn., assignor to W. H. Page & Co. Five patents.
3,906.—TRADE MARK.—Wm. Pearson and Peter Hogoboom, Ripon, Wis.
3,907.—STAIR ROD.—August Pohl, Brooklyn, N. Y.
3,908.—HANDLE CAP FOR SATCHELS.—J. M. Riley, Newark, N. J.
3,909.—THERMOMETER.—C. R. Sherman aud Wendell Macy, New Beoford, Mass.
3,910.—BAGGAGE RACK.—R. M. Snodgrass, Pittsburgh, Pa.
3,911.—COOKING STOVE.—David Stuart and Lewis Bridge (assignors to David Stuart and Richard Peterson), Philadelphia, Pa. Antedated March 1, 1870.
3,912.—SHUTTER BAR.—John Tiebout, New York city.

EXTENSIONS.

HARVESTER RAKE.—Owen Dorsey, of Newark, Ohio.—Letters Patent No. 14,250, dated March 4, 1856; reissue No. 1,067, dated Oct. 28, 1860; reissue No. 2,982, dated June 9, 1868.
WOOD-BENDING MACHINE.—J. C. Morris, Cincinnati, Ohio.—Letters Patent No. 14,405, dated March 11, 1856; reissue No. 1,212, dated May 27, 1862.

NEW BOOKS AND PUBLICATIONS.

THE PRINCIPLES OF MECHANISM AND MACHINERY OF TRANSMISSION. Comprising the Principles of Mechanism, Wheels, and Pulleys, Strength, and Proportions of Shafts, Couplings for Shafts, and Engaging and Disengaging Gear. By William Fairbairn, Esq., C. E., LL.D., F.R.S., F.G.S., Corresponding Member of the National Institute of France, and of the Royal Academy of Turin, Chevalier of the Legion of Honor, etc., etc. Philadelphia: Henry Carey Baird, Industrial Publisher, No. 406 Walnut street. Price, by mail, free of postage, $2·50.

Few names are more widely and favorably known to the mechanical and scientific world than that of Mr. Fairbairn. Whatever publication bears his name, bears a guarantee that its subject has been thoroughly thought out, and that its conclusions are presented with that clearness which characterizes all of Mr. Fairbairn's works. The volume before us contains the results of the experience and study of one of the most accomplished millwrights and engineers of the present century. It first discusses the principles of mechanism, and, passing over the elementary forms of construction, in which various mechanical movements are discussed, it takes up the general subject of the transmission of power by machinery, in which the devices in general use for this purpose are discussed at length. This is followed by a chapter on the strength of shafts, with rules for computing strength, tables of resistance to flexure, torsion, etc.; and the work is completed by an extended discussion of various forms of couplings, engaging and disengaging gear, hangers, plumber blocks, main shafts, etc., etc. It is a book which every mechanic ought to possess.

PRACTICAL METAL WORKERS' ASSISTANT. Comprising Metallurgic Chemistry, the Arts of Working all Metals and Alloys, Forging of Iron and Steel, Hardening and Tempering, Melting and Mixing, Casting and Founding, Works in Sheet Metal, the Processes dependent on the Ductility of Metals, Soldering and the most Improved Processes and Tools Employed by Metal Workers. With the Application of the Art of Electro-Metallury to Manufacturing Processes, collected from Original Sources, and from the Works of Holtzapffel, Bergeron, Leupold, Plumier, Napier, and others. By Oliver Byrne. A new Revised and Improved Edition, with Additions, by John Scoffern, M. B., William Clay, William Fairbairn, F.R.S., and James Napier. With Five Hundred and Ninety-two Engravings, Illustrating every branch of the Subject. Phildelphia: Henry Carey Baird, Industrial Publisher, No. 406 Walnut street.

The former edition of this work has, we are informed by the publisher in his preface, been exhausted for several months; but the demand for it

has remained unabated. That edition achieved a wide and well-merited popularity, and is so well known that it needs no word of praise from us. The present edition has, we see, received some very important and valuable additions. Besides careful revision of the old text, entire new chapters have been appended. Among the subjects treated in the added chapters, we find "Metallurgic Chemistry," and "Metallurgic Operations," by John Scoffern, M. B., "Recently Patented Refining Processes," "Wrought Iron in large Masses," by William Clay, and "Application of Iron to Shipbuilding," by William Fairbairn. Several chapters on various branches of Electro-Metallurgy have also been added. The chapter on "Recently Patented Refining Processes," contains a full account of the Bessemer process. This is the best American work of its class yet published.

ANNUAL OF SCIENTIFIC DISCOVERY; or, Year Book of Facts in Science and Art, for 1870, exhibiting the most Important Discoveries and Improvements in Mechanics, Useful Arts, Natural Philosophy, Chemistry, Astronomy, Geology, Biology, Botany, Mineralogy, Geography, Antiquities, etc. Together with Notes on the Progress of Science during the Year 1869. A List of Recent Scientific Publications, Obituaries of Eminent Scientific Men, etc. Edited by John Trowbridge, S. B., Assistant Professor of Physics in the Massachusetts Institute of Technology, aided by Samuel Kneeland, M.D., Professor of Zoology and Physiology in the Institute, and W. R. Nichols, Graduate of the Institute. Boston: Gould & Lincoln, 59 Washington street. New York: Sheldon & Co. London: Trubner & Co.

This annual is as usual a tolerably complete record of scientific progress for the past year. We, however, observe some omission of events which are certainly of greater importance than some which find a place in the book. On the whole, we do not think this number has been edited with the usual care. We observe also that some extracts from our journal have not been properly credited.

THE RECORDS OF LIVING OFFICERS OF THE U. S. NAVY AND MARINE CORPS. With a History of Naval Operations during the Rebellion of 1861–5, and a List of the Ships and Officers Participating in the Great Battles. Compiled from Official Sources, by Lewis R. Hammersly (late Lieutenant U. S. Marine Corps). Philadelphia: J. B. Lippincott & Co.

Three fourths of this book is occupied with short biographical sketches, useful for reference. The rest of the work is occupied in a condensed history of naval operations, and a list of the officers and vessels engaged in the most important naval battles during the war. The work will be of special interest to military and naval men.

THE MODERN PRACTICE OF AMERICAN MACHINISTS AND ENGINEERS. Including the Construction, Application, and Use of Drills, Lathe Tools, Cutters for Boring Cylinders and Hollow Work generally. With the most Economical Speed for the same; the Results Verified by Actual Practice at the Lathe, the Vise, and on the Floor. Together with Workshop Management, Economy of Manufacture, the Steam Engine, Boilers, Gears, Belting, etc., etc. By Egbert P. Watson, late of the SCIENTIFIC AMERICAN. Illustrated by Eighty-six Engravings. Philadelphia: Henry Carey Baird, Publisher, No. 406 Walnut street. Price, by mail, $2·50.

This is a practical work, written by a practical man, designed for the use of those who wish to learn the best practice as now conducted in American machine shops. Very little space is devoted to theorizing. Details of various mechanical operations are dwelt upon with clearness and minuteness. The reason for every proceeding is given in a plain and concise manner. The perusal of this work will aid many a young machinist to advance more rapidly to the performance of the most difficult operations of the craft. So far as instruction can go to assist practice in the attainment of manual skill, this books seems to have gone.

THE CAMBRIDGE PHYSICS. Comprising Hand-Book of Chemistry, Elements of Chemistry, Hand-Book of Natural Philosophy, Natural Philosophy for High Schools and Colleges, Hand-Book of the Stars, and Elements of Astronomy.

This a series of primary text-books in the physical sciences, adapted to beginners, and brought up to the latest advances in the branches of study treated. So far as we can judge from a cursory examination, they seem admirably adapted to introduce the pupil easily and naturally into the arcana of natural science.

LIPPINCOTT'S MAGAZINE, for April, has three full-page illustrations, and a choice table of contents. The publishers of "Lippincott" announce that, by special arrangement, they will commence in the May number Anthony Trollope's new story, "Sir Harry Hotspur of Humblethwaite."

CITY SUBSCRIBERS.—The SCIENTIFIC AMERICAN will be delivered in every part of the city at $3·50 a year. Single copies for sale at all the News Stands in this city, Brooklyn, Jersey City, and Williamsburgh, and by most of the News Dealers in the United States.

Caveats are desirable if an inventor is not fully prepared to apply for a patent. A Caveat affords protection for one year against the issue of a patent to another for the same invention. Patent Office fee on filing a Caveat, $10. Agency charge for preparing and filing the documents from $10 to $12. Address MUNN & CO., 37 Park Row, New York.

SUBSCRIBERS—who wish to have their volumes bound, can send them to this office. The charge for binding is $1.50 per volume. The amount should be remitted in advance, and the volumes will be sent as soon as they are bound.

RECEIPTS—When money is paid at the office for subscriptions, a receipt for it will be given; but when subscribers remit their money by mail, they may consider the arrival of the first paper a *bona-fide* acknowledgment of their funds.

Advertisements.

The value of the SCIENTIFIC AMERICAN *as an advertising medium cannot be over-estimated. Its circulation is ten times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading-rooms of the world. We invite the attention of those who wish to make their business known to the annexed rates. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. If it is worth 25 cents per line to advertise in a paper of three thousand circulation, it is worth $1·50 per line to advertise in one of thirty thousand.*

RATES OF ADVERTISING.

Back Page - - - - $1·00 a line.
Inside Page - - - - - 75 cents a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter-press.

WANTED.—A Man with some means, who understands Car Building. Address WAGONER & MATTHEWS, Westminster, Md.

U.S. PIANO CO. N.Y. $290. FOR 1ST CLASS 7 OCT SENT ON TRIAL—CIRCULARS MAILED FREE.

PAT. Railroad Cross-tie Lifter does the work of 3 hands in laying cross ties. State Rights for sale. Address J. R. SNEED, Nashville, Tenn.

SEND 50c. for your Stencil Plate, Brush, Ink, etc., and 1 bottle of Silver Plateing Fluid, to M. M. SIGLER, Wilksbarre, Pa.

SAW GUMMERS—For Upright and Circular Saws, and Single & Double Upsets and other Saw Tools. Send for circulars and prices. G. A. PRESCOTT, Sandy Hill, N. Y.

Baird's Catalogue

of Practical and Scientific Books.

MARCH 1, 1870. 81 Pages. 8vo.

The undersigned begs leave to call the particular attention of the 100,000 readers of the SCIENTIFIC AMERICAN to his new and enlarged CATALOGUE OF PRACTICAL and SCIENTIFIC BOOKS, and to say that he is desirous of placing a copy in the hands of *each and every one of them*, and is prepared to do so.

He will therefore consider it a favor if they will one and all send their names and addresses, when catalogues shall be promptly mailed, *free of postage*.

He desires to repeat what he has already said, that *no such list of Industrial Books, the publication of one house*, is to be found in the United States or Great Britain; Germany and France alone being able to produce such. There is scarcely a trade, profession, occupation, or art which has not its treatise or treatises in this collection.

Sent by mail, free of postage, to any address.
HENRY CAREY BAIRD,
Industrial Publisher, 406 Walnut st., Philadelphia.

Important Advance
ON THE DRAFT AND
Easement of Carriages.

JACKSON'S PATENT OSCILLATING Improvement on Wheeled Vehicles has been tested by weights over an obstruction, on a wagon with wheels of 11 and 12 inches in diameter; crank of axles 1¼ in.; obstruction 1¼ inches in hight, of sufficient length to check the front wheels; draft with fixed axles, 8 lbs.; with oscillating axles, 6 lbs.; giving a positive gain of 2 lbs., or ¼ less than fixed axles.

N. B. The greater the obstruction, the greater the oscillation, and consequent momentum to overcome fixed obstacles, and the greater the gain over fixed axles in passing the same obstructions. By this construction the draft will move the weight before the axis of the wheels, producing a second lever between them and the draft. This improvement is applicable to all wheeled vehicles, from a car to a wheelbarrow. See SCIENTIFIC AMERICAN, September 25, 1869. Address
SAMUEL JACKSON,
No. 149 High street, Newark, Essex county, N. J., where the improvement on a full sized wagon may be inspected, also with tests of draft, models, etc.

BAIRD'S

INDUSTRIAL BOOKS.

LIST NO. 4.

Byrn.—The Complete Practical Brewer; or, Plain, Accurate, and Thorough Instructions in the Art of Brewing Beer, Ale, Porter, including the Process of making Bavarian Beer, all the Small Beers, such as Root Beer, Gingerpop, Sarsaparilla Beer, Mead, Spruce Beer, etc., etc. Adapted to the use of Public Brewers and Private Families. By M. La Fayette Byrn, M.D. With illustrations. 12mo............$1 25

Byrn.—The Complete Practical Distiller: Comprising the most perfect and exact Theoretical and Practical Description of the Art of Distillation and Rectification; including all of the most recent improvements in distilling apparatus; instructions for preparing spirits from the numerous vegetables, fruits, etc.; directions for the distillation and preparation of all kinds of brandies and other spirits, spirituous and other compounds, etc., etc.; all of which is so simplified that it is adapted not only to the use of extensive distillers, but for every farmer, or others who may wish to engage in the art of distilling. By M. La Fayette Byrn, M.D. With numerous engravings. 12mo............$1 50

Byrne.—Pocketbook for Railroad and Civil Engineers: Containing New, Exact, and Concise Methods for Laying out Railroad Curves, Switches, Frog Angles, and Crossings; the Staking out of Work; Leveling; the Calculation of Cuttings; Embankments; Earth-work, etc. By Oliver Byrne. Illustrated, 18mo, full bound............$1 75

Byrne.—The Handbook for the Artisan, Mechanic, and Engineer: Comprising the Grinding and Shaping of Cutting Tools, Abraisive Processes, Lapidary Work, Gem and Glass Engraving, Varnishing and Lackering, Apparatus, Materials, and Processes for Grinding and Polishing, etc. By Oliver Byrne. Illustrated by 185 Wood Engravings. 8vo............$5

Byrne.—The Essential Elements of Practical Mechanics: For Engineering Students, based on the Principle of Work. By Oliver Byrne. Illustrated by Numerous Wood Engravings, 12mo............$3 63

Byrne.—The Practical Metal-worker's Assistant: Comprising metallurgic chemistry; the arts of working all metals and alloys; forging of iron and steel; hardening and tempering; melting and mixing; casting and founding; works in sheet metal; the processes dependent on the ductility of metals; soldering; and the most improved processes and tools employed by metal workers. With the application of the art of electro-metallurgy to manufacturing processes; collected from original sources, and from the works of Holtzapffel, Bergeron, Leupold, Plumier, Napier, and others. By Oliver Byrne. A new, revised, and improved edition, with additions by John Scoffern, M.B., William Clay, Wm. Fairbairn, F.R.S., and James Napier. With five hundred and ninety-two engravings; illustrating every branch of the subject. 8vo. 652 pages............$7

Byrne.—The Practical Model Calculator: For the engineer, mechanic, manufacturer of engine work, naval architect, miner, and millwright. By Oliver Byrne. 8vo, nearly 600 pages............$4 50

☞ The above, or any of my Books, sent by mail, free of postage, at the publication price. My new and enlarged Catalogue of PRACTICAL & SCIENTIFIC BOOKS, 81 pages, 8vo, now ready, complete to Feb. 15, 1870, will be sent, free of postage, to any one who will favor me with his address.

HENRY CAREY BAIRD.
Industrial Publisher, 406 Walnut St.
PHILADELPHIA.

ESTB. ENOCH MORGAN'S SONS' 1809
(211 Washington st., N. Y.)

SAPOLIO
THE BEST THING OUT.

For Cleaning Windows (without water); removing Stains from Marble and Paint; Polishing Knives, (no scratching); Washing Dishes, Scrubbing Floors, Floor Cloth, Tables, Bath Tubs, etc.; Polishing Tin, Brass, Iron, Copper, and Steel Wares; Removing Gums, Oil, Rust, and Dirt from machinery. Indispensable for House Cleaning, and all uses (except washing clothes). It costs but a few cents, and is sold by all good Grocery, Drug, and Notion Stores.

MERRICK & SONS,
Southwark Foundery,
430 Washington Ave., Philadelphia, Pa.,

MANUFACTURE NASMYTH & DAVY STEAM HAMMERS

CORNISH PUMPING, BLAST, HORIZONTAL, VERTICAL, AND OSCILLATING ENGINES.

Gas Machinery of all descriptions.
Sugar Refineries fitted up complete, with all modern apparatus.
New York office 62 Broadway.

TO PATENTEES.
The St. Cloud Hotel,
Corner 9th and F sts., Washington, D. C.,
Opposite Patent Office and Masonic Temple, and
One Block from
GENERAL POSTOFFICE DEPARTMENT.
The F street cars, communicating with the Capitol, Executive Mansion, Treasury, War, and Navy Departments, and the B. and O. R. R. Depot, pass the door.
MRS. E. A. POLLARD, Proprietress.

TO LET—25-H. P., with one room, 40x56 ft., warmed with steam. Help plenty. Spruce, Birch, Beach, and Maple lumber abundant. Address W. C. WALKER, Mendon, Vt.

JUST PUBLISHED
—BY—
Gould & Lincoln,
59 WASHINGTON ST., BOSTON,
The Annual of Scientific Discovery;
—OR—
Year Book of Facts in Science and Art,
FOR 1870.

EXHIBITING the most important Discoveries and Improvements in Mechanics, useful Arts, Natural Philosophy, Chemistry, Astronomy, Meteorology, Biology, including Zoology, Physiology, and Botany—Mineralogy, Geology, Geography, Antiquities, etc., together with a list of recent Scientific publications, Obituaries of eminent Scientific Men, etc. Edited by

JOHN TROWBRIDGE, S. B.,

Assistant Professor of Physics in the Massachusetts Institute of Technology, assisted by SAMUEL KNEELAND, M D., Professor of Zoology and Physiology in the Institute; and W. R. NICHOLS, Graduate of the Institute. With a fine likeness of Prof. BENJAMIN PIERCE. 12mo. Cloth. Price............$2

This vol. of the Annual is a valuable and interesting one, embracing a Record of a vast number of remarkable discoveries, important facts—curious, entertaining, and highly instructive—for the Farmer, the Mechanic, the Merchant, the Lawyer, the Physician, the Statesman, the Clergyman, the Scientific Man, the Artist, the Teacher. And no School, no Academy, no College, nor any well-selected private library should be without this work.

Asphalte Roofing Felt.

A PATENT ARTICLE OF GOOD THICKNESS and durability, suitable for steep or flat roofs. Can be applied by an ordinary mechanic or handy laborer. Send for circular to
EDWARD H. MARTIN,
72 Maiden Lane, and 7 Liberty st., New York.

Cotton Manufacturers,

YOUR ATTENTION is invited to Pusey's Patent Rug Spinning Frames, the best in use. Send for circular. PUSEY BROTHERS, Wilmington, Del.

OVERSHOT WHEEL FOR SALE.—A good Iron wheel—all iron except the buckets. Pit Wheel, Crown and Spur Wheel, together with Upright Shaft, Point and Step. Will be sold cheap. Address J. W. MOUNT, Medina, N. Y.

AMES' IRON WORKS IMPROV'D PORTABLE ENGINES are the Best and Cheapest. See if they are not before deciding. 3 to 40-H. P. always on hand. Also, Hoisters, Stationaries, Saw and Burr Mills, and other Machinery. E. P. HAMPSON, 38 Courtlandt st., New York.

Painter,

Gilder, and Varnisher's Companion.

Containing Rules and Regulations in everything relating to the Arts of Painting, Gilding, Varnishing, Glass Staining, Graining, Marbling, Sign Writing, Gilding on Glass, and Coach Painting and Varnishing; Tests for the Detection of Adulterations in Oils, Colors, etc.; and a Statement of the Diseases to which Painters are peculiarly liable, with the Simplest and Best Remedies. Thirteenth Edition. Revised, with an Appendix. Containing Colors and Coloring—Theoretical and Practical. Comprising Descriptions of a great variety of Additional Pigments, their Qualities and Uses, to which are added, Dryers, and Modes and Operations of Painting, etc. Together with Chevreul's Principles of Harmony and Contrast of Colors. 12mo. Cloth............$1·50

☞ The above or any of my Books sent by mail, free of postage, at the publication prices. My new revised and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS, 81 pp. 8vo, now ready, complete to March 1, 1870, will be sent, free of postage, to any one who will favor me with his address.

HENRY CAREY BAIRD,
Industrial Publisher,
406 Walnut st., Philadelphia, Pa.

N. L. AUSTIN & CO.,—Sole Manufacturers of the Atlantic Water Elevator, the Best article for raising water in use. Town, County, and State Rights for sale. Agencies established if desired. Address N. L. AUSTIN & CO., Norwalk, Ct.
☞ A few good, reliable agents wanted to sell Territorial rights.

FOUNDERY AND MACHINE SHOP FOR SALE.—One of the oldest and best located in Minnesota, has an extensive patronage, and is in good running order. Motive power, steam. It is furnished with a large assortment of patterns for mill work, agricultural machinery, and repairs, stoves, kettles and a great variety of other work. The finest quality of molding sand close at hand, free. Situation excellent for the manufacture of agricultural implements of any kind. Located in a thriving town of 3000 inhabitants, 2 railroads, navigable river, and country well settled. It offers sure inducements to a business man. Address Box 233, St. Peter, Minn.

PETELER'S PORTABLE RAILROAD CO., are now ready to receive orders for Tracks & Cars, and take contracts for excavating, etc. Address, 35 Park Row, New York. Send for circular.

A DOUBLE MAGAZINE!—TWO IN ONE!—PACKARD'S MONTHLY is consolidated with the PHRENOLOGICAL JOURNAL. See April Number for Portraits and Characters of T. H. Sibley, Henry Bergh, Men of the Rocky Mountains, Life in China, N. C. Ely, S. S. Packard, Governors of New York, What Makes a Good Writer, Diet for Brain Workers, Free Moral Agency, Philosophy of Faith, Yale Sketches, Modesty of Genius, "Cheek," Capital vs. Labor. etc. Thirty cents, or $3 a year. Newsmen have it.
S. R. WELLS,
No. 389 Broadway, N. Y.

WATSON'S

Practice of Machinists and Engineers.

The Modern Practice of American Machinists and Engineers: Including the Construction, Application, and Use of Drills, Lathe Tools, Cutters for Boring Cylinders, and Hollow Work Generally, with the most Economical Speed for the same; the Results verified by Actual Practice at the Lathe, the Vise, and on the Floor. Together with Workshop Management, Economy of Manufacture, the Steam Engine, Boilers, Gears, Belting, etc., etc. By EGBERT P. WATSON, late of the "Scientific American." Illustrated by eighty-six engravings. In one volume, 12mo............$2 50

☞ By mail free of postage.

CONTENTS.—PART I—CHAPTER I. The Drill and its Office. II. The Drill and its Office—continued. III. The Drill and its Office—continued.

PART II.—LATHE WORK. IV. Speed of Cutting Tools. V. Chucking Work in Lathes. VI. Boring Tools. VII. Boring Tools—continued; Abuses of chucks. VIII. Boring Steel Cylinders and Hollow Work; Experiments with Tools needed; Conservatism among Mechanics. IX. Turning Tools. X. Turning Tools—continued. XI. Turning Tools—continued. XII. Turning Tools—continued. XIII. Turning Tools—continued.

PART III.—MISCELLANEOUS TOOLS AND PROCESSES. XIV. Learn to Forge your own Tools; Manual Dexterity; Spare the Centers. XV. Rough Forgings. XVI. How to use Calipers. XVII. A Handy Tool; Hammers. XVIII. Keying Wheels and Shafts. XIX. Taps and their Construction; Tapping Holes; Abuse of Files. XX. Defective Iron Castings; "Burning" Iron Castings; How to Shrink Collars on a Shaft. XXI. Are Scraped Surfaces Indispensable? Oil Cups; Drilling and Turning Glass. XXII. Manipulation of Metals.

PART IV.—STEAM AND STEAM ENGINE. XXIII. The Science of Steam Engineering. XXIV. Piston Speed of Steam Engines. How to set a Slide Valve; To find the Length of the Rod; An improperly set Valve; Lead; The Lead Indicator. XXVI. Defect in Steam Engines. XXVII. The Slide Valve; Balanced Slide Valves. XXVIII. Connection of Slide Valves; The Pressure on a Slide Valve. XXIX. Condensation of Steam in Long Pipes. XXX. Packing Steam Piston. XXXI. Pistons without Packing. XXXII. Bearing Surfaces. XXXIII. Lubricating the Steam Engine. XXXIV. Derangement of Steam Engines. XXXV. Cold Weather and Steam Engines; Oil entering a Steam Cylinder against Pressure. XXXVI. Explosions of Steam Boilers; Boiler Explosions; Is your Boiler Safe? Faulty Construction of Steam Boilers; Troubles Incident to Steam Boilers; Starting Fires under Boilers; Steam Boilers and Electricity; Field for Improvement in Steam Boilers. XXXVII. Location of Steam Gages and Indicators; The Laws of Expansion.

PART V.—GEARS, BELTING, AND MISCELLANEOUS PRACTICAL INFORMATION. XXXVIII. Relating to Gears. XXXIX. Leather Bands; Belting. XL. Cone Pulleys for given Velocities; Formulæ for Cutting Screw Threads. XLI. How to lay up an Eight Strand Gasket; To Turn an Elbow; Fly-wheels for Long Shafting; Velocity of Mechanism. XLII. Various useful Items.

☞ The above, or any of my Books, sent by mail, free of postage, at the publication price. My new and enlarged Catalogue of PRACTICAL AND SCIENTIFIC BOOKS, 81 pages, 8vo., now ready, complete to March 1, 1870, will be sent, free of postage, to any one who will favor me with his address.

HENRY CARY BAIRD,
Industrial Publisher, 406 Walnut St.
PHILADELPHIA.

IMPORTANT To Owners of Steam Boilers. Scale in Steam Boilers removed without loss of time or injury to the iron. Send for circulars to
GEO. W. LORD, 107 West Girard Ave. Phil'a, Pa.

Philadelphia Machinery Agency.
KELLY, HOWELL & LUDWIG,
917 Market st., Philadelphia, Pa.

THE GREAT WISELL LATHE (Unequaled), Turns Spokes of all sizes, Whiffletrees, Spring-bars, Hammer, Sledge, Pick, Plow, & Yankee Ax Handles, Plow Beams, Wagon Axletrees, etc. Address
E. R. WISELL,
Manufacturer and Patentee, at Warren, Ohio.

STENCIL DIES!

Price for Complete Set, ¼ inch	\$24·00
" " " " ⅜ "	26·50
" " " " ½ "	28·00

MADE FROM THE FINEST STEEL.
And Warranted in every respect. Samples free. Address
S. M. SPENCER, Box 47, Brattleboro, Vt.

THE CHALMERS-SPENCE
Patent Non-Conductor
For covering Boilers, Pipes, etc. Saves fuel, is non-bustible, never deteriorates. Head Office foot of Ninth st., E. R., N.Y. Branch 1202 and 1204 N. Second st., St. Louis, Mo. Agencies Boston, Philadelphia, and New Orleans.

PAPER-BAG MACHINES—Having the very latest improvements, and superior to all others, for sale and license, by
B. S. BINNEY,
64 Kilby street, Boston, Mass.

SWINGLE'S PATENT COMBINED
Boring and Mortising Machine.
It bores and mortises at one operation. Having had this in constant use for several years at our own works, we guarantee its giving satisfaction. Price \$200.
THE ALLEN AGRICULTURAL WORKS,
Corner Jay and Plymouth Sts, Brooklyn, N. Y., between Catherine and Bridge Street Ferries.

WOODBURY'S PATENT
Planing and Matching
and Molding Machines, Gray & Wood's Planers, Self-oiling Saw Arbors, and other wood working machinery.
S. A. WOODS, { 91 Liberty street, N. Y.;
Send for Circulars. { 67 Sudbury street, Boston

1832. SCHENCK'S PATENT 1870.
Woodworth Planers.
And Re-sawing Machines, Wood and Iron Working Machinery, Engines, Boilers, etc. JOHN B. SCHENCK & SON, Matteawan, N. Y., and 118 Liberty st., New York.

FOR SALE.—The Stockholders of the "Dubuque Manufacturing Company," Dubuque, Iowa, desiring to discontinue the business of the Company for themselves, on account of want of capital to successfully prosecute the same, hereby offer their extensive work-shops for sale. The shops have been in operation about fifteen years. The principal branch of manufacture is thrashing machines, which are well and favorably known throughout the Northwest, being second to none manufactured in the United States. The shops have also full facilities to do all kinds of mill and machinery work. Dubuque has a population of over 20,000 persons, and with the excellent facilities for shipment by river and rail, this affords a brilliant investment to any party having the capital and experience. For further particulars apply to DUBUQUE MANUF'ING CO., Dubuque, Iowa.

WROUGHT IRON
BEAMS & GIRDERS

THE Union Iron Mills, Pittsburgh, Pa. The attention of Engineers and Architects is called to our improved Wrought-iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided, we are prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithograph address the Union Iron Mills, Pittsburgh, Pa.

PATENTEES
Who have failed in their efforts to dispose of their rights will do well to consult us, either personally or by mail, free of charge. Many valuable inventions are lying dormant for want of proper management that might realize a fortune for their owners if placed in our hands and brought to the attention of capitalists. Only those will be accepted which we feel satisfied can be sold, as our object is solely the realization of a commission. A candid opinion can therefore be relied upon. No charge for services unless successful.
References on application. E. E. ROBERTS & CO.,
Consulting Engineers, 15 Wall st., New York.

Send for Illustrated and Descriptive Circular. T. W. FAY, Patentee and Manufacturer, Camden, N. J.

RIDER'S GOVERNOR
CUT-OFF ENGINE.
MANUFACTURED by the Delamater Iron Works, West 13th st., New York. The prominent features of this engine are: Economy equal to any; perfect regulation of speed by cut-off; entire absence of delicate or complicated mechanism; simplicity of design and non-liability of derangement; requiring no more care than common engines.
NOTE.—This improvement can be applied in many cases to existing engines. Pamphlets sent on application.

A Splendid Work of Art.
The undersigned have recently published the fine Ste Engraving entitled
Men of Progress---
AMERICAN INVENTORS.
The Plate is 22x36 inches,
And contains the following group of illustrious inventors, namely: Prof. Morse, Prof. Henry, Thomas Blanchard, Dr. Nott, Isaiah Jennings, Charles Goodyear, R. J. Saxton, Dr. W. T. Morton, Erastus Bigelow, Henry Burden, Capt. John Ericsson, Elias Howe, Jr., Col. Samuel Colt, Col. R. M. Hoe, Peter Cooper, Jordan L. Mott, C. H. McCormick, James Bogardus, and Frederick E. Sickles. The likenesses are all excellent, and Mr. Sartain, who stands at the head of our American Engravers on Steel, in a letter addressed to us, says "that it would cost \$4,000 to engrave the plate now," which is a sufficient guarantee of the very high character of the Engraving as a work of art. Price of single copies \$10, sent free. But to any desirin to subscribe for the SCIENTIFIC AMERICAN, the paper will be sent for one year, together with a copy of the engraving, upon receipt of \$10. The picture is also offered as a premium for Clubs of Subscribers as follows:
Any one sending ten names, for one year, and \$30, will have one picture; or twenty names, for one year, and \$50, will also have one picture.
For Specimen of the Paper and Prospectus, address
MUNN & CO., 37 Park Row, New York.

\$25 A DAY.—40 new articles for Agents, Samples sent FREE. H. B. SHAW, Alfred, Me.

SEWING-MACHINE MACHINERY AND Machinists' Tools, in great variety, from new patterns, with many recent improvements, and first-class workmanship. Also, Rotary and Reciprocating Hydraulic Engines, for running printing presses, blowing organs, etc., ready for delivery, by
THE PRATT & WHITNEY COMPANY,
Hartford, Conn.
Send for description.

To Electro-Platers.
BATTERIES, CHEMICALS, AND MATERIALS, in sets or single, with books of instruction manufactured and sold by THOMAS HALL, Manufacturing Electrician, 19 Bromfield st., Boston, Mass. Illustrated catalogue sent free on application.

Every Man his Own
PRINTER.—With one of our presses, and the material accompanying it, every man can do his own printing, thus saving much time and expense. Circulars containing full information about these Presses, prices, recommendations, etc., mailed free on application. Specimen books of types, cuts, borders, etc., etc., 10 cents.
ADAMS PRESS CO., 53 Murray st., New York.

WROUGHT-Iron Pipe for Steam, Gas, and Water; Brass Globe Valves and Stop Cocks, Iron Fittings, etc. JOHN ASHCROFT, 50 John St., N. Y

Iron & Woodworking
Machinery Depot, New and Second-hand.
GEORGE L. CUMMINGS, 140 Center st., New York.

THE AMERICAN FAMILY
KNITTING MACHINE
Is presented to the public as the most Simple, Durable, Compact, and Cheap Knitting Machine ever invented. PRICE, ONLY \$25.
This machine will run either backward or forward with equal facility; makes the same stitch as by hand, but far superior in every respect. WILL KNIT 20,000 STITCHES IN ONE MINUTE, and do perfect work. It will knit a pair of stockings (any size) in less than half an hour. It will knit Close or Open, Plain or Ribbed Work, with any kind of coarse or fine woolen yarn, or cotton, silk or linen. It will knit stockings with double heel and toe, drawers, hoods, sacks, smoking caps, comforts, purses, muffs, fringe, afghans, nubias, undersleeves, mittens, skating caps, lamp wicks, mats, cord, undershirts, shawls, jackets, cradle blankets, leggins, suspenders, wristers, tidies, tippets, tufted work, and, in fact, an endless variety of articles in every-day use, as well as for ornament.
FROM \$5 TO \$10 PER DAY can be made by any one with the American Knitting Machine, knitting stockings etc., while expert operators can even make more, knitting fancy work, which always commands a ready sale.
FARMERS can sell their wool at only forty to fifty cents per lb., but by getting the wool made into yarn at a small expense, and knitting it into socks, two or three dollars per pound can be realized. On receipt of \$25 we will forward a machine as ordered.
We wish to procure active AGENTS EVERYWHERE, to whom the most liberal inducements will be offered. Address
American Knitting Machine Company,
BOSTON, MASS., OR ST. LOUIS, MO.

RICHARDSON, MERIAM & CO., Manufacturers of the latest improved Patent Daniels' and Woodworth Planing Machines, Matching, Sash and molding, Tenoning, Mortising, Boring, Shaping Vertical and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway, Cut-off, and Rip-saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufactory, Worcester, Mass. Warehouse, 107 Liberty st., New York. 17 1

PORTABLE STEAM ENGINES AND Boilers, Complete.

8-Horse Power	\$ 700
12 " "	900
16 " "	1200
20 " "	1500
25 " "	1650

For Sale by H. B. BIGELOW & CO.,
New Haven, Conn.

SILICATE OF SODA, IN ITS VARIOUS forms, manufactured as a specialty, by Philadelphia Quartz Co., 783 South 2d st., Philadelphia, Pa.

THE NOVELTY IRON WORKS
Have For Sale at their Shop, foot of East 12th st., Lathes Planers, and all kinds of Machines for manufacturing Engines, Tools, etc.

OTIS' SAFETY HOISTING *Machinery.*
OTIS BROTHERS & CO.
NO. 309 BROADWAY, NEW YORK.

Niagara Steam Pump.
CHAS. B. HARDICK,
No. 9 Adams st., Brooklyn N. Y

SHINGLE AND HEADING MACHINE—Law's Patent with Trevor & Co.'s Improvements. The Simplest and Best in use. Also, Shingle, Heading, and Stave Jointers, Equalizers, Heading Turners, Planers etc. Address TREVOR & CO., Lockport, N. Y.


Heater, Filter, and
LIME EXTRACTOR
FOR
STEAM BOILERS.
Send for Circulars to
D. F. WELSH & CO.,
Manufacturers, Bucyrus, O.

TODD & RAFFERTY, Manufacturers and DEALERS IN MACHINERY.
Works, Paterson, N. J.; Warerooms, 10 Barclay st., N. Y Boilers, Steam Pumps, Machinists' Tools. Also, Flax, Hemp, Rope, and Oakum Machinery, Snow's and Judson's Governors, Wright's pat. Variable Cut-off & other engines.

MODELS, PATTERNS, EXPERIMENTAL, and other machinery, Models for the Patent Office built to order by HOLSKE MACHINE CO., Nos. 528, 530 and 532 Water st., near Jefferson. Refer to SCIENTIFIC AMERICAN office. 14 tf

ASHCROFT'S LOW-WATER DETECTOR will insure your Boiler against explosion. JOHN ASHCROFT, 50 John st., New York. 16 tf

BURDON IRON WORKS,—Manufacturers of Pumping Engines for Water Works, High & Low Pressure Engines, Portable Engines of all kinds, Sugar Mills, Screw, Lever, Drop, & Hydraulic Presses, Machinery in general. Hubbard & Whittaker, 102 Front st., Brooklyn.

VINEGAR.—How Made from Cider, Wine, Molasses, or Sorghum in 10 hours, without using drugs. For circulars, address F. I. SAGE,
Vinegar Maker, Cromwell Conn.

R. BALL & CO., Worcester, Mass., Manufacturers of Woodworth's, Daniel's, and Dimension Planers; Molding, Matching, Tenoning, Mortising Shaping, and Boring Machines; Scroll Saws, Re-Sawing, Hand Boring, Wood Turning Lathes and a variety of other Machines for Working Wood. Also, the best Patent Door, Hub, and Rail Car Mortising Machines in the world. Send for our Illustrated Catalogue.
RICHARD BALL. E. P. HALSTED

L. W. Pond's New Tools.
NEW AND IMPROVED PATTERNS—Lathes, Planers, Drills, Milling Machines, Boring Mills, Gear and Bolt Cutters Punches and Shears for iron. Dealer in
MACHINERY.
Works at Worcester, Mass. Office, 98 Liberty st., N. Y
S. N. HARTWELL, General Agent.

PATENT FOR SALE.—An Article of Tin, in general use, requiring but small means to manufacture, will be sold on easy terms. Apply to
HENRY J. DAVISON,
77 Liberty st., New York.

GREGORY'S SEED CATALOGUE
MY ANNUAL CATALOGUE, containing a list of many novelties, besides all the standard vegetables of the garden (OVER 100 OF WHICH ARE OF MY OWN GROWING), with a choice list of Flower seed will be forwarded GRATIS to all. I warrant my seed, shall prove as represented. I warrant it shall reach each purchaser. I warrant all money forwarded shall reach me. Send for a catalogue.
JAMES J. H. GREGORY, MARBLEHEAD, MASS.

ROBERT McCALVEY, Manufacturer of HOISTING MACHINES AND DUMB WAITERS.
602 Cherry st., Philadelphia, Pa.

TRADE MARK.
SOLID EMERY WHEELS are guaranteed superior to any now in the market, and sent out on trial.
Price list upon application.
UNION STONE CO.,
32 Pemberton Square,
Boston, Mass.

Agents! Read This!
WE WILL PAY AGENTS A SALARY of \$30 per week and expenses, or allow a large commission, to sell our new and wonderful inventions. Address M. WAGNER & CO., Marshall, Mich.

THE INVENTOR'S AND MECHANIC'S GUIDE.—A valuable book upon Mechanics, Patents, and New Inventions. Containing the U. S. Patent Laws, Rules and Directions for doing business at the Patent Office; 112 diagrams of the best mechanical movements, with descriptions; the Condensing Steam Engine, with engraving and description; How to Invent; How to Obtain Patents; Hints upon the Value of Patents; How to sell Patents; Forms for Assignments; Information upon the Rights of Inventors, Assignees and Joint Owners; Instructions as to Interferences, Reissues, Extensions Caveats, together with a great variety of useful information in regard to patents, new inventions, and scientific subjects, with scientific tables, and many illustrations 108 pages. This is a most valuable work. Price only 25 cents. Address MUNN & CO., 37 Park Row, N. Y.

Foundery Materials,
Facings, Sand, Clay, Bricks, Crucibles, Tools, Vitriol, Babbit Metal Belting, etc. VANTUYL & Co., 373 Cherry st., N.Y

THE BEST PUNCHING PRESSES ARE made by the Inventor and Patentee of the famous Eccentric Adjustment. Infringements upon said Patent will be severely dealt with. N. C. STILES,
Middletown, Conn.

STEAM AND WATER GAGES, STEAM Whistles, Gage Cocks, and Engineers' Supplies.
16 tf JOHN ASHCROFT, 50 John St., New York.

THE WOODWARD STEAM-PUMP MANUFACTURING COMPANY, Manufacturers of the Woodward Pat. Improved Safety Steam Pump and Fire Engine, Steam, Water, and Gas Fittings of all kinds. Also Dealers in Wrought-iron Pipe, Boiler Tubes, etc. Hotels Churches, Factories, & Public Buildings, Heated by Steam Low Pressure. Woodward Building, 76 and 78 Center st., cor. of Worth st, (formerly of 77 Beekman st.), N.Y. All parties are hereby cautioned against infringing the Pat. Right of the above Pump. G. M. WOODWARD, Pres't

LATHE CHUCKS—HORTON'S PATENT —from 4 to 36 inches. Also for car wheels. Address E. HORTON & SON Windsor Locks Conn

Andrews' Patents.
Noiseless, Friction Grooved, Portable, and Warehouse Hoisters.
Friction or Geared Mining & Quarry Hoisters.
Smoke-Burning Safety Boilers.
Oscillating Engines, Double and Single, half to 100-Horse power.
Centrifugal Pumps, 100 to 100,000 Gallons per Minute, Best Pumps in the World, pass Mud, Sand, Gravel, Coal, Grain, etc., without injury.
All Light, Simple, Durable, and Economical.
Send for Circulars.
WM. D. ANDREWS, ANDREWS & BRO.,
414 Water street, New York.

HINKLEY KNITTING MACHINE
FOR Family Use—simple, cheap, reliable. Knits everything. AGENTS WANTED. Circular and sample stocking FREE. Address HINKLEY KNITTING MACHINE CO., Bath, Me., or 176 Broadway, N.Y.

CAMDEN
Tool and Tube Works,
Camden, N. J. Manufacturers of Wrought Iron Tube, Brass Work and Fittings, and all the most improved TOOLS for Screwing, Cutting, and Fitting Pipe. Screwing Machines for Pipe, of five different sizes. Pipe Tongs, Common and Adjustable; Pipe Cutters, Pipe Vises, Taps, Reamers, Drills, Screwing Stocks, and Solid Dies. Peace's Patent Screwing Stocks, with dies. No. 1 Screws ¼, ⅜, ½, ¾ Pipe. Price complete, \$10. No. 2 Screws, 1, 1¼, 1½ Pipe, \$20. No. 3 both screws and cuts off, 2½, 3, 3½, 4, \$65

WOODWORTH PLANERS a SPECIALTY —From new patterns of the most approved style and workmanship. Wood-working Machinery generally. Nos. 24 and 26 Central, corner Union street, Worcester Mass. Warerooms, 42 Cortlandt street, New York.
WITHERBY, RUGG & RICHARDSON.

STOCKS, DIES, AND SCREW PLATES Horton's and other Chucks. JOHN ASHCROFT, 50 John st., New York. 16 1

BUERK'S WATCHMAN'S TIME DETECTOR.—Important for all large Corporations and Manufacturing concerns—capable of controlling with the utmost accuracy the motion of a watchman or patrolman, as the same reaches different stations of his beat. Send for a Circular. J. E. BUERK,
P. O. Box 1,057, Boston, Mass.
N. B.—This detector is covered by two U. S. patents. Parties using or selling these instruments without authority from me will be dealt with according to law.

Chas. E. Emery,
CIVIL AND MECHANICAL ENGINEER,
No. 7 Warren st., New York.
Drawings and Specifications furnished. Steam Machinery practically tested. Inventions examined for Capitalists. Refers, by permission, to Horatio Allen, Esq., Capt. John Ericsson, C. H. Delamater, Esq., Hecker & Bro., and other eminent engineers and manufacturers

PORTABLE STEAM ENGINES, COMBINING the maximum of efficiency, durability and economy, with the minimum of weight and price. They are widely and favorably known, more than 750 being in use. All warranted satisfactory or no sale. Descriptive circulars sent on application. Address
J C HOADLEY & CO Lawrence, Mass

MILLER'S FALLS CO. Manufacture Barber's Bit Brace, No. 87 Beekman st., New York.

AMERICAN TINNED SHEET IRON.
Coating uniformly over the entire sheet, by an entirely new and patented process. All sizes and gages on hand and made to order.
H. W. BUTTERWORTH & SON,
25 eow tf 29 and 31 Haydock st., Philadelphia, Pa.

B. K. BLISS & SON,
Nos. 41 Park Row, and 151 Nassau St,
NEW YORK,
Importers, Growers and Dealers in Garden, Field and Flower seeds, Horticultural Implements and Garden Requsites,
Would inform their friends and the public that the Sixteenth Annual edition of their **Illustrated Seed Catalogue** and **Guide to the Flower and Kitchen Garden,** is now ready for distribution.
No pains or expense has been spared in preparing this edition to make it the most complete work of the kind ever published in this country.
It contains **120** pages of closely printed matter; upwards of Two Hundred Choice Engravings of Favorite Flowers and Vegetables, and two beautifully colored Lithographs of the celebrated *Lilium Auratum* and a group of *Prize Pansies*; and a descriptive list of upwards of Two Thousand species and varieties of Flower and Vegetable Seeds, including all the novelties of the past season, with directions for their culture; also a list of upwards of One Hundred Varieties of Choice *Gladiolus*; with many other Summer-Flowering Bulbs, and much useful information upon the subject of gardening generally.
A copy will be mailed to all applicants inclosing *twenty-five cents*; customers supplied without charge.
Bliss' Gardeners' Almanac mailed to all applicants upon receipt of a 3-cent stamp.
Address **B. K. BLISS & SON.**
P. O. Box 5712, New York.

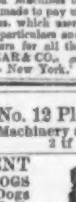
MASON'S PAT'T FRICTION CLUTCHES are Manufactured by Volney W. Mason & Co., Providence, R. I. Agents, R. BROOKS & CO., 123 Ave. D, New York · TAPLIN RICE & CO. Akron, Ohio 16 tfeow


Independent Steam
BOILER SUPPLY
OR
Feed Pump.
RELIABLE FOR HOT OR COLD WATER.
Circulars sent free. COPE & CO.,
No. 118 East 2d st., Cincinnati, Ohio.

Molding Machinery.
THE MOST VALUABLE MACHINE FOR Planing Irregular and Straight Work in all branches of Wood-Working, is the Combination Molding and Planing Machine Co.'s "Variety Molding and Planing Machine." Our improved guards make it safe to operate; our combination collars save one hundred per cent; and for planing, molding, and cutting irregular forms, our Machine is unsurpassed. The right to make and vend these Machines is owned solely by us, and we will defend Purchasers in case litigation is forced upon them by any parties pretending to own Patents on any part of our Variety Machine. COMBINATION MOLDING AND PLANING MACHINE CO., 424 East 23d st., or Postoffice Box 3230 New York City. Silas M. Hamilton, Baltimore Samuel Leggert, New York. 19 tfeow

Gear's Variety Moulding Machine,
WARRANTED THE BEST IN THE WORLD FOR Moulding and Cutting Irregular Forms, with Patent Improvements for Combination Cutters, and Patent Guard to protect operator and material. Secured by six Patents Deeds of Right to use furnished with every Machine sold, to protect parties in using them. Before purchasing Combination Moulding and Planing Machine Co.'s or Grosvenor's Mongrel Infringing Machines (which they and their agents, in behalf of the Singer Sewing Machine ..., and the Central Pacific R. R. Co., and others to whom they had sold Machines to be used out of the State of New York, have been made to pay us for using,) or Ball's or Fay's infringing Machines, which users have had to pay us for right to use. Address for particulars and Machines, Sole Owners and Lawful Manufacturers for all the United States, except New York A. S. & J. GEAR & CO.,
New Haven, Conn., or 91 Liberty Street, New York.

MACHINERY.—S. C. HILLS, No. 12 Platt st., New York, dealer in all kinds of Machinery and Machinists' supplies. 2 tf a


LECOUNT'S PATENT HOLLOW LATHE DOGS AND CLAMPS.—A set of 8 Dogs from ⅜ to 2-in., inclusive, \$8. A set of 12 from ⅜ to 4-in., \$17·30. Five sizes Machinists' Clamps, from 2 to 6-in., inclusive, \$11. Send for Circular.
C. W. LeCOUNT.
South Norwalk, Conn.


PLATINUM. H. M. RAYNOR 57 Bond st., N. Y.


Excelsior LUBRICATOR
For cylinders of Engines. The most durable and best oil cup, manufactured by
B. E. LEHMAN,
Lehigh Valley Brass Works,
Bethlehem, Pa.
Send for descriptive circular.

H. BOARDMAN, Lancaster, Pa.—Superior Patent Cork-cutting Machinery, Hard-laid Twine Cord, and Rope Machinery, with Pat. Stop & Condenser

CINCINNATI BRASS WORKS. — Engineers' and Steam Fitters' Brass Work. Best Quality at very Low Prices. F. LUNKENHEIMER, Prop'r,
Cincinnati, Ohio.

H. B. BIGELOW & CO., Bridge Engineers and Iron Bridge Builders.
New Haven, Ct.

HENRY W. BULKLEY, ENGINEER, Mechanical Designs, Detail Drawings, Estimates, etc., 70 Broadway, New York.

Advertisements.

Advertisements will be admitted on this page at the rate of **$1·00** *per line. Engravings may head advertisements at the same rate per line, by measurement, as the letter-press.*

BALL, BLACK & CO.

Nos. 565 and 567 BROADWAY

Offer an Unequaled Assortment of

JURGENSEN, NARDINE. JACOT, SALTZMAN. NICOUD, GERARD, FRODSHAM, PEARDON, GORDING, RUGENSTEIN, HARRISON, TAYLOR.

ALSO, A FULL LINE OF AMERICAN

WATCHES,

At the Lowest Price.

Manufacturers of Machine Screws, all kinds, for Sewing Machines, Guns, Clocks, Scissors, Trusses, etc.
C. DUCREUX & CO.,
93 Elizabeth st., near Grand, New York.

ROPER'S NEW

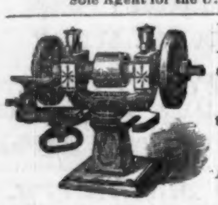
Caloric Engines.

R. C. E. CO., 49 Cortlandt st., N. Y. Send for circular.

WATCH MAKERS.

Illustrated Catalogue of P. S. STUBS' Tools and Files, Twist Drills and Chucks, Screw Plates and Taps, Machine Screws, Emery Wheels, Foot Lathes, etc.
GOODNOW & WIGHTMAN, 23 Cornhill, Boston.

FRENCH BAND SAW MACHINES, SAWS, Taper Files, etc., Machines for Scroll, Re-sawing, and Log; Mongin & Co.'s Band Saw Blade all Sizes, on hand and made to order.
All Styles of Band Saw Machines in operation at Mahogany Mill, 10th st., E. R.
GEORGE GUEUTAL,
Sole Agent for the U. S., 39 West 4th st., N. Y.



PATENT EMERY GRINDERS, For grinding TOOLS, Gumming Saws, Dressing Castings, Grinding and Polishing Metals, etc. Important saving of time, labor, and files by their use.
Three Sizes.
Manufactured by
AMERICAN TWIST DRILL COMPANY,
Woonsocket, R. I.

DREDGING.

THE Subscribers beg to call the attention of Engineers, Contractors, and Corporations to their NEW PATENT DREDGE PLANT, by which Harbors, Docks, Canals, Bars, Rivers, and Channels can be deepened or cut from 5 feet to 40 feet in any soil, with great speed and economy. The Dredge Plant has been already supplied to the Clyde Trust, the Government Works at Carlingford, Ireland, the Great North Sea Ship Canal, Holland, the Bristol Channel, Corporations of Hartlepool, Greenock, Aberdeen, Scotland, and elsewhere. Can be delivered in any part of the world, and is particularly adapted for exposed localities.
W. SIMONS & CO.,
Engineers and Shipbuilders, London Works, Renfrew.

OLIVER'S PATENT POWDER.

THE great advantage this Powder possesses over the common powder is that it can be made stronger without increased cost of material, it also makes less smoke and is inexplosive when not confined.
This powder can be manufactured with perfect safety to the workmen employed, as there is no danger of explosion in its manufacture. The mode of manufacture is simpler and more thorough than the present process, requiring fewer hands and much less cost of machinery in proportion to the quantity manufactured.
Companies desirous of making arrangements for its manufacture, will please address to me direct.
PAUL A. OLIVER,
Rooms 46 and 45 Trinity Building, New York.

SMALL

Water Wheels.

We are not acquainted with S. D. Parker, M.D., and have never had any correspondence with him, but his very fine and interesting account of a SMALL TURBINE in No. 5, Vol. 22, SCIENTIFIC AMERICAN, requires at least our sincerest thanks.

Below is Mr. Williams' letter to us in regard to the same wheel.

ITHACA, N. Y., March 11, 1870.

MESSRS. JAMES LEFFEL & CO.

Gentlemen: Dr. Parker's statements in the SCIENTIFIC AMERICAN of 29th Jan. are substantially correct. I am now running both of the little wheels you manufactured for me; and must admit they operate beautifully, and beyond my most sanguine expectations—even better than you would promise. They exhibit splendid workmanship, being made strong, entire of brass and steel, and highly finished. With one under 95 ft. head, using but two thirds of its full power, I drive 4 pairs of 4½ ft. burrs, strong, and all the machinery of the entire mill. At full capacity, as by your tables, it uses 14 2-3 sq. inches of water, discharging 490 cubic feet per minute, and will drive easily 6 run stones and all necessary machinery. The other wheel under 90 ft. head, with less than half its full power, is driving my plaster mill, one stone cracker and 4 1-3 ft. burr, with necessary machinery, turning out about 1 ton ground plaster per hour. At full capacity this wheel uses 11 1-4 sq. inches of water, discharging 345 cubic feet per minute.

Your "Patent Spherical Flumes," encasing the wheels, are a splendid affair—under this tremendous pressure scarcely leaking a drop. I have attached to them over 500 ft. of main and branch pipes, the main pipe feeding the 11½ in. wheel, being just 500 ft. in length. The whole affair is a complete success, and I think I now have—for the size of the stream—the best water power in America.

Respectfully yours,
H. C. WILLIAMS.

We will warrant our wheels to give a higher percentage of power than any wheel tested at Lowell. Large, new, illustrated pamphlet mailed free on application.
JAMES LEFFEL & CO.,
Springfield, Ohio, and New Haven, Conn.

Woodward's National Architect. 1,000 Working Plans and Details for Suburban and Village Houses, with perspectives, elevations, section, full detail drawings, specifications, estimates. Pospaid, $12.

Harney's Barns, Out-buildings & Fences. 200 Designs, including Stables, Gates, Gateways, and Stable Fittings. Postpaid, $10.

Woodward's Cottages and Farm Houses. 188 Designs and Plans. Postpaid, $1·50.

Woodward's Suburban & Country Houses. 70 Designs and Plans. Postpaid, $1·50.

Woodward's Country Homes. 150 Designs and Plans of Moderate Cost. Postpaid, $1·50.

Burn's Architectural Drawing Book. 300 Self-instructing illustrations. Postpaid, $2.

Complete illustrated priced catalogue of all books on Architecture and Agriculture mailed free.
GEO. E. WOODWARD, Publisher,
191 Broadway, New York.

Pratt's "Astral" Oil.

A SAFE LIGHT FOR OUR HOMES.

☞ Pratt's Astral is a perfectly safe illuminating oil. It is a distinct product, and unlike any oil ever offered to the public; is strictly pure, containing no mixtures or chemicals; burns in the ordinary kerosene lamp, with a clear and brilliant light; emits no unpleasant odor while burning, and is *wholly free from danger of explosion.* Families will find it an acceptable substitute for kerosene. The following is but one of many testimonials:

New York, Dec. 3d, 1869.

MR. CHAS. PRATT, Dear Sir:

I wish to add my testimony to the good qualities of the "Astral" Oil. A few nights ago, at my residence in Clifton, N. J., the servant girl accidentally knocked over a lighted lamp filled with your "Astral" Oil. The lamp fell to the floor and was instantly broken, scattering the contents over the carpet. The wick, which was still burning, fell into the oil, but did not ignite it, and was picked up and blown out, without causing any damage, further than the loss of the lamp. I have been burning your "Astral" Oil for a number of months, and am highly pleased with it. I consider it perfectly safe, and would use no other. Yours very truly, C. D. SPENCER,
With H. B. Claflin & Co., 140 Church st., N. Y.

☞ The Astral Oil is for sale by druggists and grocers everywhere, and at wholesale and retail by
Oil House of CHARLES PRATT,
108 Fulton Street, New York.
Send for Circular and price lists.

EMPLOYMENT.

$200 A Month with Stencil Dies. Samples free. Address S. M. SPENCER, Brattleboro, Vt.

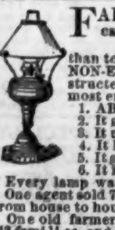
A SPECIALITY—Metal Planing Machines, with valuable improvements, patented.
C. WHITCOMB & CO., Manufacturers,
Worcester, Mass. Established 1852.

MODEL MAKER AND MACHINIST.
Working Models and Experimental Machinery, Gear Cutting, and Stud and Rivet Turning.
J. F. WERNER, 62 Center st., N. Y.

PAT. SOLID EMERY WHEELS AND OIL STONES, for Brass and Iron Work, Saw Mills, and Edge Tools. Northampton Emery Wheel Co., Leeds, Mass.

STEAM ENGINES & BOILERS

FROM 4 to 500-H. P., including celebrated Corliss Patent Variable Cut-off Engines Slide Valve Stationary Engines Portable Engines, etc. Also, Circular Mulay, & Gang Saw Mills Sugar Cane Mills, Shafting, Pulleys, etc. Wheat and Corn Mills Circular Saws, Belting, etc. Send for Circular and Price List.
WOOD & MANN
STEAM ENGINE CO.,
Utica, N. Y.



FARMERS and CANVASSERS can find no more pleasant and profitable WINTER EMPLOYMENT, than to sell the PERKINS & HOUSE PATENT NON-EXPLOSIVE KEROSENE LAMP, constructed on Sir Humphrey Davy's plan. The most eminent scientific men pronounce it

1. ABSOLUTELY SAFE.
2. It gives twice as much light.
3. It uses 38 per cent less oil.
4. It lasts a lifetime.
5. It gives no odor in burning.
6. It is a successful rival of gas.

Every lamp warranted as recommended.
One agent sold 72 lamps the first two days in going from house to house.
One old farmer sold 103 lamps in a town containing 113 families, and said, "I have lived to be a blessing to my kind." Good agents clear $12 per day.
For descriptive circular and terms, address
VOTAW, MONTGOMERY & CO.,
Cleveland, Ohio, and 19 Courtlandt st., New York.

BOILER FELTING SAVES TWENTY-five per cent of Fuel. JOHN ASHCROFT,
18 tf 50 John st., New York.

908 PRIZES, Worth from $1·50 to $100 in Greenbacks, Awarded to Subscribers & agents for WOOD'S HOUSEHOLD MAGAZINE, the largest and best Dollar Monthly in the world. Similar prizes to be repeated soon. Full particulars in March Number. For sale by all Newsdealers, or sent with Catalogue of Premiums on receipt of 10c. Address
S. S. WOOD, Newburgh, N. Y.

McNAB & HARLIN, Manufacturers of Wrought Iron Pipe and fittings, Brass Cocks, Valves, Gage Cocks, Whistles, Water Gages, and Oil Cups, Harlin's Patent Lubricator Plumbers' Brass Work, Getty's Patent Pipe Cutter, Getty's Patent Proving Pump and Gage. No. 86 John st., New York.

BARNES' CAST STEEL & WROUGHT Iron Self-adjustable Pipe and Studd Wrench, for Railroad Shops, Gas Fitters, Steam Engines, etc. Price $5 each. Address C. TRESSELT, Fort Wayne, Ind.

Price One Dollar.

507 MECHANICAL MOVEMENTS.
By HENRY T. BROWN,
The Best Book for Engineers, Machinists, Draftsmen, Inventors, Manufacturers, and Artisans generally. Contains 507 beautiful engravings of Mechanical Movements, each one accompanied with a concise description. Price $1. By mail $1·12. Address
THEO. TUSCH, 37 Park Row, New York.

LAMB KNITTING MACHINE

"THE OLD RELIABLE."—Over 10,000 Machines in use—sold mostly by canvassing agents. The only kind that knits circular and flat work of all sizes, and narrows and widens on both. Send for circular and SAMPLE STOCKING.
LAMB MACHINE CO., Chicopee Falls, Mass.
NEW YORK OFFICE, No. 2 Clinton Place.

E. Allen & Co's NEW MODEL Cartridge Revolver.
Weight only 6 oz. Can be carried in the vest pocket. Seven Shots, 22-100 calibre. Lightest and best Revolver in the world.
Address, ETHAN ALLEN & CO.
WORCESTER, Mass.

Factory, Trenton, N. J.... Office, No. 2 Jacob st., N. Y.
☞ Branch Office for Pacific Coast, No. 606 Front st San Francisco, Cal.

London..................48 Cannon street.

H. KOHNSTAMM,
Manufacturer of

ULTRAMARINE,

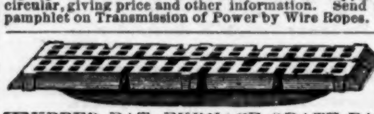
And Importer of English, French, and German Colors, Paints, and Artists' Materials, Bronzes, and Metals. No. 100 Chambers street, between Broadway and Church st., New York.

PATTERN LETTERS KNIGHT BROS.

WIRE ROPE.

Manufactured by
JOHN A. ROEBLING'S SONS,
Trenton N. J.

FOR Inclined Planes, Standing Ship Rigging Bridges, Ferries, Stays or Guys on Derricks & Cranes Tiller Ropes, Sash Cords of Copper and Iron, Lightning Conductors of Copper. Special attention given to hoisting rope of all kinds for Mines and Elevators. Apply for circular, giving price and other information. Send for pamphlet on Transmission of Power by Wire Ropes.



TUPPER PAT. FURNACE GRATE BAR. Received the Highest Premium ever awarded in the United States (a Silver Medal), and honorable mention at the Paris Exposition. Guaranteed more durable, and to make more steam, with less fuel, than any other Bar. Reduced price. Send for descriptive pamphlet.
L. B. TUPPER,
120 West street, New York city.

THE

Tanite Emery Wheel.

Does not Glaze, Gum, Heat, or Smell. Address
THE TANITE CO.,
Stroudsburg, Monroe Co., Pa.

Reynolds' Turbine Water Wheels.

The Oldest and Newest. All others only imitations of each other in their strife after complications to confuse the public. We do not boast but quietly excel them all in staunch reliable, economical power. Beautiful pamphlet free. GEO. TALLCOT, 96 Liberty st., New York.
Gearing. Shafting.

IRON PLANERS, ENGINE LATHES, Drills, and other Machinists' Tools, of Superior Quality, on hand and finishing. For sale Low. For Description and Price, address NEW HAVEN MANUFACTURING CO., New Haven, Conn. 5 tf os

ROOT'S WROUGHT IRON SECTIONAL

Safety Boiler.

Composed of best Wrought Iron Tubes, tested to 500 pounds; no large sheet iron, shell or thin cast iron to explode. Absolutely safe, economical, durable, and efficient. Send for pamphlet. Also, Steam Engines, Steam Pumps, etc. ROOT STEAM ENGINE CO.,
95 and 97 Liberty st., New York.

Improved Awning.

COMMUNICATIONS concerning purchase of Rights should be addressed to J. B. ARMSTRONG, Urbana, Ohio.

It obviates the necessity for posts or supports at the front edge, provides a neat and effective shelter for the awning when rolled up, is perfectly easy to spread out or roll up, is simple in construction, and remarkably tasteful in appearance. It can be fully or partially extended to admit or exclude light without the aid of a step ladder, and in a moment's time. We consider this form of Awning as far superior to any form of canvas awning heretofore employed, combining, as it does, durability, convenience, and comeliness. On exhibition at Whitlock's, Nos. 35 and 37 Park Place, New York. See Scientific American dated Nov. 27, 1869.

A MERCHANT OF RESPONSIBILITY, and in Good Standing, desires to make an arrangement with some large manufacturer to act as agent for the sale of goods. He will be prepared to make advances upon goods consigned to his house, to an amount of $25,000 to $100,000. A business in metals preferred. Address E. E. H., Box No. 4,800, New York Postoffice.

☞ T. V. Carpenter, Advertising Agent. Address hereafter, Box 773, New York city.

HARRISON SAFETY BOILER.

First class Medal, World's Fair, London, 1862.
And American Institute Fair, New York, 1869.
Over 1000 Boilers in use.
Address Harrison Boiler Works, Philadelphia, Pa., or
JOHN A. COLEMAN, Agent,
110 Broadway, New York, and 139 Federal st., Boston.

SAWS. EVERY DESCRIPTION Guaranteed under a forfeiture of $1000, to cut the most lumber with the least expense

Henry Disston & Son,

PHILADELPHIA. Special attention paid to our new style Circular, Belt, Cross-cut, Mill, and Hack Saws. Orders received from England, Ireland, and the Continent.

Oak Leather Belting.

Manufactured by CHAS. A. SCHIEREN, 92 Gold st., N.Y

SCHLENKER'S PATENT
BOLT CUTTER
NEW INVENTION. ADDRESS,
HOWARD IRON WORKS, BUFFALO, N.Y.

P. BLAISDELL— Manufacturer of the Blaisdell Patent Drill Presses & other Machinists' Tools, Jackson st., Worcester, Mass.

THE COMMERCIAL AGENCY

REMOVAL, And 1870 Register.

THE PROPRIETORS,

Messrs. McKillop, Sprague & Co.,

Have removed to their New and Spacious Office, 109 and 111 Worth st., one door east of Broadway. The accommodations to meet the demands of increasing business, are double the room heretofore occupied, making it the most extensive, best managed, and thoroughly fitted up in the United States for this business.

The REGISTER, published in January, is more complete and full than any heretofore, making over five hundred thousand (500,000) names, carefully rated with reference to their character and Commercial standing, embracing the capital of each, from one thousand dollars to over millions, the history of which subscribers can obtain from the records at our office. This Agency has been established over one quarter of a century, and purpose still further to develop its facilities to aid in disposing of credit.

We invite business men to call at our new establishment, and see for themselves, also, the completeness of our business system.

McKILLOP, SPRAGUE & CO.,
109 & 111 Worth st.,
One door east of Broadway, New York.

REPEATING FIRE-ARMS

FOR SALE, viz:—

5,000	Winchester	Repeating	Muskets.
5,000	"	"	Carbines.
5,000	"		Sporting Rifles.
2,000	Spencer	"	Muskets.
30,000	"	"	Carbines.
500	"	"	Sporting Rifles.
2,000	Joslyn Single Breech-loading Carbines.		

Metallic Cartridges of all sizes, by
WINCHESTER REPEATING ARMS CO.,
New Haven Conn.

ILLUSTRATED MANUALS and Catalogues sent by mail for 10c. each.

Mathematical Instruments............	116 pages
Optical Instruments..................	54 "
Stereopticons and Magic Lanterns..	88 "
Philosophical Instruments...........	64 "

JAMES W. QUEEN & CO.,
924 Chestnut st., Philadelphia, Pa.

$20 A DAY TO MALE AND FEMALE Agents to introduce the BUCKEYE $20 SHUTTLE SEWING MACHINES. Stitch alike on both sides, and is the only *LICENSED SHUTTLE MACHINE* sold in the United states for less than $40. All others are infringements, and the seller and user are liable to prosecution and imprisonment. Outfit free. Address *W. A. HENDERSON & CO., Cleveland, Ohio.*

CARVALHO'S

Steam Super-Heater,

Saves fuel, and supplies Dry Steam for Heating, Boiling etc. HENRY W. BULKLEY, Engineer, 70 Broadway, N.Y

L. L. Smith, NICKEL PLATER,

65 CROSBY ST., NEW YORK.

LICENSES granted by the U.N. Co., 173 BROADWAY

THE SCIENTIFIC AMERICAN FOR 1870.

A SPLENDID PREMIUM.

This Illustrated Weekly Journal of Practical Information, Art, Science, Mechanics, Invention, Chemistry, and Manufactures—Entered its Twenty-fifth Year on the 1st of January.

The SCIENTIFIC AMERICAN stands at the head of the Industrial Journals of the world in point of Circulation and Influence.

Every number has Sixteen Imperial pages, embellished with Engravings of New Inventions, Machinery, Tools for the Workshop, House, and Farm, also Public Buildings, Dwelling Houses, and Engineering Works.

The Illustrated Department of the SCIENTIFIC AMERICAN is a very striking feature, and has elicited the praise of the Press; and all articles appearing in its columns are written in a popular and instructive style.

To Inventors and Mechanics the SCIENTIFIC AMERICAN has special value and interest, from the fact that it furnishes an Official List of Patents issued, with copious notes of the principal American and European Patents.

The Publishers offer as a Premium for Clubs the large and splendid Steel Engraving—"American Inventors," as follows: Any one sending ten subscribers for one year and $30, will receive a picture, or twenty subscribers and $50, will receive one picture. A club may be made up from different postoffices.

For full particulars and sample copies of the SCIENTIFIC AMERICAN, address the Publishers.

Terms of the SCIENTIFIC AMERICAN: Single copies one year, $3·00; six months, $1·50; and one dollar for four months. To Clubs of ten and upward, $2·50 each per annum.

MUNN & CO.,
37 Park Row, New York.

PRINTED with the Ink of CHAS. ENEU JOHNSON & CO., Tenth and Lombard st., Philadelphia, 59 Gold, corner Ann st., New York.